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ABSTRACT

This curriculum guide and student manual provide instructional materials for a two-credit course to provide students with entry-level skills in the area of electrical trades. The guide contains 12 units. Unit I explains how to use the guide and lists essential elements for all vocational programs, for Trade and Industrial Education, and for this course as well as a suggested sequence by unit. Units II through XI contain the 10 specific areas of instruction: safety; introduction to electrical trades; tools, equipment, and materials for electrical trades; theory of electricity; generating and distributing electrical power; electrical codes; blueprints and schematic diagrams; planning the job; electrical installation; and troubleshooting. Each unit contains lesson plans with essential element; unit and specific objectives; lists of tools, equipment, materials, and references; introduction; teacher activities; and evaluation. Unit XII provides lesson plans covering common essential elements. Appendixes include modification techniques for special populations; references and resources; answers to assignment sheets and pre/posttests; and pre/posttests. The student manual provides materials for Units II-XI. A student information sheet for each lesson provides unit and specific objectives and general information. Assignment sheets and job sheets are also provided. (YLB)

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ELECTRICAL TRADES I

Curriculum Guide

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OCCUPATIONAL CURRICULUM LAB — EAST TEXAS STATE UNIVERSITY

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ELECTRICAL TRADES I
CURRICULUM GUIDE

DEVELOPED
BY
SHELIA I. GRANT-GOLD, ED.D.

OCCUPATIONAL CURRICULUM LABORATORY
TRADE AND INDUSTRIAL EDUCATION
EAST TEXAS STATE UNIVERSITY

IN COOPERATION WITH

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John D. Hutchings, Branch Manager, Jim Kenney Electrical Co., Longview, Texas
Mr. Robert McEnroe, Plant Manager, Dietzgen Corp., El Paso, Texas
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Shelia I. Grant-Gold, Ed.D.
Curriculum Specialist
Trade and Industrial Education

PREFACE

The Occupational Curriculum Laboratory at East Texas State University is striving to provide needed curriculum materials to vocational instructors within the state.

The purpose of this publication is to assist instructors in improving instruction. As these materials are used, it is hoped that student performance will improve and that students will be better prepared to assume a role in the field of electrical trades.

Instructional materials in this publication are written in terms of student performance using measurable objectives. This approach augments the teaching-learning process. Criterion-referenced evaluation instructions are provided for a uniform measurement of student progress. In addition to evaluating recall information, teachers are encouraged to evaluate the other areas, including process and product.

Every effort has been made to make this publication basic, readable, and by all means, usable. Three vital areas of instruction (motivation, personalization, and localization) are not included in this publication; however, they should be capitalized on by the instructor. Only then will this publication really become a vital part of the teaching-learning process.

UNIT I

HOW TO USE

HOW TO USE THE CURRICULUM GUIDE
FOR
ELECTRICAL TRADES I

Electrical Trades I is an occupationally specific course. It is a two - credit hour program. The intent of the program is to provide students with entry level skills which will be useful in the immediate future. The program will provide students with a better understanding of the knowledge, skills, and training needed to succeed in the area of electrical trades.

Unit I

This curriculum guide is intended to help instructors and administrators of Electrical Trades I. The first unit of the curriculum guide lists how to use the curriculum guide; common essential elements for all vocational programs; essential elements for Trade and Industrial Education; essential elements for this course; and, a suggested sequence by unit. The essential elements define the scope of the program. The suggested sequence by unit list is intended to graphically show units of instruction may be applied. The following ten units of the curriculum guide focus on specifics of the occupational area of instruction in detail. The final unit covers additional common essential elements. Appendices appear at the end of this publication.

Unit II through XI

The ten specific areas of instruction include: Safety; Introduction to Electrical Trades; Tools, Equipment, and Materials for Electrical Trades; Theory of Electricity; Generating and Distributing Electrical Power; Electrical Codes; Blueprints and Schematic Diagrams; Planning the Job; Electrical Installation; and Troubleshooting.

Recommended times have hot been given as each instructor is to tailor the course to meet local needs. Each unit of the curriculum guide represents the organization and use of the instructional materials available. The guide has been printed on loose leaf pages to make rearrangement of the instruction materials easier for the instructor.

Unit XII

The final section of this curriculum guide provides lesson plans covering common essential elements. These lessons may be used at any time within the course. Each instructor is encouraged to tailor the sequence of the lessons to meet individual classroom needs.

Essential Elements Page

The essential elements common to all vocational programs; essential elements for trade and industrial programs; and the essential elements for Electrical Trades I are listed in the front of this publication. This provides for easy access by the instructor.

Lesson Plans

Lesson plans are provided in this publication. Lessons are formatted to serve as documentation for what is being taught in the class. Copies may be distributed to local administration officials.

Appendices

Appendices are to provide the teacher with additional sources of instructional material for use in the class. The appendices include: Teacher References and Resources; Student References and Resources; Audio-visual Material and Computer Software; and, Modification Techniques for Special Populations.

75.50 Vocational Education.

(a) The elements in this subsection are common to all vocational programs in this section offered at grades seven and eight and shall be included in each course at the appropriate level, unless otherwise indicated. They are described here to preclude repetition in each course. Every school offering vocational education at grades seven and eight shall provide courses which include the following essential elements:

(1) Leadership concepts and skills. The student shall be provided opportunities to:

(A) demonstrate skills, characteristics, and responsibilities of leaders and effective group members;

(B) demonstrate a knowledge of parliamentary procedure principles;

(C) plan and conduct leadership activities; and

(D) prepare for effective citizenship and for participation in our democratic society.

(2) Concepts and skills related to successful employment and/or postsecondary training. The student shall be provided opportunities to:

(A) identify employment opportunities and preparation requirement in the chosen field;

(B) identify effective methods to secure and terminate employment;

(C) demonstrate effective communication skills both oral and written and follow through on assigned tasks;

(D) demonstrate dependability and punctuality;

(E) demonstrate productive work habits and attitudes;

(F) understand the importance of taking pride in the quality of work performed;

(G) recognize the dignity in work;

(H) develop skills in planning and organizing work;

(I) apply required methods and sequences when performing tasks;

(J) apply principles of time management and work simplification when performing assigned tasks;

(K) identify ethical practices and responsibilities; and

(L) understand the importance of the application of organizational policies and procedures.

(3) Concepts and skills associated with entrepreneurship. The student shall be provided opportunities to:

- (A) identify opportunities for business ownership;
- (B) understand the risk and profit motive factor;
- (C) understand the elements and advantages of the free enterprise system; and
- (D) explain the role of small business in the free enterprise system.

(4) Concepts and skills related to safety and safe working conditions. The student shall be provided opportunities to identify and apply safe working practices to all training situations.

(5) Concepts and skills associated with human relations and personality development. The student shall be provided opportunities to:

- (A) understand the importance of maintaining good health and proper appearance for effective job performance;
- (B) understand oneself and others;
- (C) exercise self-control;
- (D) accept and use criticism;
- (E) recognize basic human relationships as they relate to business success; and
- (F) demonstrate characteristics for successful working relationships.

(6) Concepts and skills related to personal and business management. The student shall be provided opportunities to:

- (A) explain how management assists in reaching personal and family goals;
- (B) explain the management process;
- (C) describe the role of management in controlling stress;
- (D) identify and understand personal checking accounts;
- (E) identify and understand personal loan application processes;
- (F) identify and understand different financial institutions;
- (G) identify the role and functions of business management;
- (H) understand the lines of authority; and
- (I) identify effective supervisory techniques.

75.88 Trade and Industrial Education.

(a) The elements in this subsection are common to all trade and industrial courses unless otherwise indicated and shall be included in each course at the appropriate level. They are described here to preclude repetitions in each course. Every school offering trade and industrial education shall provide courses which include the following essential elements:

(1) Leadership concepts and skills. The student shall be provided opportunities to:

(A) demonstrate skills, characteristics, and responsibilities of leaders and effective group members;

(B) demonstrate a knowledge of parliamentary procedure principles;

(C) plan and conduct leadership activities; and

(D) prepare for effective citizenship and for participation in our democratic society.

(2) Concepts and skills related to successful employment and/or postsecondary training. The student shall be provided opportunities to:

(A) identify employment opportunities and preparation requirements in chosen fields;

(B) identify effective methods to secure and terminate employment;

(C) demonstrate effective communication skills both oral and written and follow through on assigned tasks;

(D) demonstrate dependability and punctuality;

(E) demonstrate productive work habits and attitudes;

(F) understand the importance of taking pride in the quality of work performed;

(G) recognize the dignity in work;

(H) develop skills in planning and organizing work;

(I) apply required methods in sequences when performing tasks;

(J) apply principles of time management and work simplification when performing assigned tasks;

(K) identify ethical practices and responsibilities; and

(L) understand the importance of the application of organizational policies and procedures.

(3) Concepts and skills associated with entrepreneurship. The student shall be provided opportunities to:

(A) identify opportunities for business ownership;

(B) understand the risk and profit motive factor;

(C) understand the elements and advantages of the free enterprise system; and

(D) explain the role of small business in the free enterprise system.

(4) Concepts and skills related to safety and safe working conditions. The student shall be provided opportunities to identify and apply safe working practices to all training situations.

(5) Concepts and skills associated with human relations and personality development. The student shall be provided opportunities to:

(A) understand the importance of maintaining good health and proper appearance for effective job performance;

(B) understand oneself and others;

(C) exercise self-control;

(D) accept and use criticism;

(E) recognize basic human relationships as they relate to business success; and

(F) demonstrate characteristics for successful working relationships.

(6) Concepts and skills related to personal and business management. The student shall be provided opportunities to:

(A) explain how management assists in reaching personal and family goals;

(B) explain the management process;

(C) describe the role of management in controlling stress;

(D) identify and understand personal checking accounts;

(E) identify and understand personal loan application processes;

(F) identify and understand different financial institutions;

(G) identify the role and functions of business management;

(H) understand the lines of authority; and

(I) identify effective supervisory techniques.

(7) Concepts and skills associated with the specific occupation being taught. The student shall be provided opportunities to:

(A) understand the basic concepts of and develop proficiency in the occupational area for which instruction/training is provided;

(B) develop a fundamental understanding of mathematical principles and scientific procedures;

(C) understand terminology utilized;

(D) identify tools, equipment, and materials used; and

(E) develop and demonstrate appropriate techniques for the selection, use, maintenance, and storage of tools, equipment, and materials.

ESSENTIAL ELEMENTS
ELECTRICAL TRADES I

(h) Electrical trades (two-three units) shall include the essential trade and industrial education elements and the following essential elements:

(1) Concepts and skills associated with residential wiring. The student shall be provided opportunities to:

(A) develop a basic understanding of the theory of electricity;

(B) understand the processes of generating and distributing electrical power and the role of the electric utility company;

(C) understand, identify, and apply electrical codes regulating residential electrical construction;

(D) read and interpret residential blueprints and schematic diagrams;

(E) plan residential electrical service entrance and individual and general purpose branch circuits;

(F) identify and properly install electrical switch and outlet boxes, residential service entrance, power panel, power feeders, internal and external light fixtures and receptacles;

(G) identify and demonstrate proper techniques for the installation of various conductors and connectors; and

(H) troubleshoot residential electrical problems.

SUGGESTED SEQUENCE BY UNIT

The units in this guide appear in the same sequence as the essential elements. This does not mean the occupational areas must be taught in that order.

This course may be taught in any one of the possible sequences. The best order to present the units will depend on the experience of the teacher and the needs of the local independent school district.

The sequence listed below is suggested by the staff who developed the material. The teacher and/or the administration is responsible for determining and documenting the best sequence of presenting the units within the course.

Order	Unit	Occupational Area
1.	II.	Safety
2.	III.	Introduction to Electrical Trades
3.	IV.	Tools, Equipment, and Materials for Electrical Trades
4.	V.	Theory of Electricity
5.	VI.	Generating and Distributing Electrical Power
6.	VII.	Electrical Codes
7.	VIII.	Blueprints and Schematic Diagrams
8.	IX.	Planning the Job
9.	X.	Electrical Installation
10.	XI.	Troubleshooting

UNIT II

SAFETY

LESSON PLAN II-1

ELECTRICAL TRADES I

UNIT: Safety

TOPIC: Electrical Safety Terms and Definitions

ESSENTIAL ELEMENT(S): Common (4); T&I (4)

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to match the terms and definitions associated with electrical safety.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: Chalkboard

REFERENCES:
General Construction Trades: Electrical
Electrical Trades I
Student Information Sheet/Electrical Safety Terms and Definitions-SM-3
Assignment Sheet/Electrical Safety Terms and Definitions-SM-5

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Focus student's attention on the importance of safety. Discuss how knowing the terms associated with safe working practices will make it easier to follow safety procedures. By the end of the lesson, you will be able to recognize terms and definitions associated with electrical safety.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Electrical Safety Terms and Definitions as a guide, discuss the importance of knowing the terms used in realtion to electrical safety.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Call on individual students to give the definition of a term.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use AS/Electrical Terms and Definitions as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Electrical Safety Terms and Definitions.

SUMMARY/CLOSURE
In this lesson you have learned a number of terms and definitions associated with electrical safety. An understanding of safe working practices will assist you in working safely.

THE NEXT LESSON IS: Using Electricity Safely

LESSON PLAN II-2

ELECTRICAL TRADES I

UNIT: Safety

TOPIC: Using Electricity Safely

ESSENTIAL ELEMENT(S): Common (4); T&I (4)

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to discuss the safe use of electricity.

TOOLS AND EQUIPMENT: Extension coards with splice, worn or damaged insulation, missing ground, etc. Overhead projector.

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparency from information sheet showing various plugs.

REFERENCES:
Safety for the Industrial Student
Electrical Trades I
Student Information Sheet/Using Electricity Safely-SM-7
Assignment Sheet/Electricity-SM-11

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Focus student's attention on the importance of safety. Discuss how electricity is used safely. By the end of the lesson, you will be able to discuss the safe use of electricity.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Using Electricity Safely as a guide, present safety information.

2. Show examples of unsafe power cords.

3. Show TM of plugs for electrical cords.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

4. Have students list unsafe conditions.

5. Have students list unsafe acts.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

6. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use AS/Electricity as independent practice. Give students an opportunity to demonstrate electrical safety.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Electricity and observing students as they demonstrate electrical safety.

SUMMARY/CLOSURE
In this lesson you have learned how electricity may be used safely. An understanding of safe working practices will assist you in working safely.

THE NEXT LESSON IS: Emergency Treatment of the Accident Victim

LESSON PLAN II-3

ELECTRICAL TRADES I

UNIT: Safety

TOPIC: Emergency Treatment of the Accident Victim

ESSENTIAL ELEMENT(S): Common (4); T&I (4)

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to discuss proper emergency treatment of the accident victim.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: First aid supplies

TEACHING AIDS: Make transparencies from drawings in the information sheet.

REFERENCES:
Safety for the Industrial Student
Electrical Trades I
Student Information Sheet/Emergency Treatment of the Accident Victim-SM-13
Assignment Sheet/First Aid-SM-21

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Focus student's attention on the importance of safety. Discuss that safety comes first; however, accidents do occur. By the end of the lesson, you will be able to discuss proper emergency treatment of the accident victim.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Emergency Treatment of the Accident Victim as a guide, present information on first aid.

2. Demonstrate various methods used to treat accident victims.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

3. Discuss the specific types of first aid required for different types of injuries.

4. Discuss the various types of fractures.

5. Demonstrate the pressure points on the body and the positions for shock victims.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

6. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use AS/First Aid as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/First Aid.

SUMMARY/CLOSURE
In this lesson you have learned that accidents do occur. You have also learned that there are specific treatments for different types of injuries.

THE NEXT LESSON IS: Treating an Accident Victim

LESSON PLAN II-4

ELECTRICAL TRADES I

UNIT:	Safety
TOPIC:	Treating an Accident Victim
ESSENTIAL ELEMENT(S):	Common (4); T&I (4)
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to treat an accident victim.

TOOLS AND EQUIPMENT:	Broom with wooden handle and first aid kit, overhead projector
MATERIALS:	Clean cloth, soap, and water
TEACHING AIDS:	Transparencies from information sheet
REFERENCES:	Safety for the Industrial Student Electrical Trades I Student Information Sheet/Emergency Treatment of the Accident Victim-SM-13 Job Sheet/Treating an Accident Victim-SM-23

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Focus student's attention on the importance of safety. Discuss that it is important to know what to do when accidents occur. By the end of the lesson, you will be able to treat an accident victim.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Emergency Treatment of the Accident Victim as a guide, review the information on first aid.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Have each student complete JS/Treating an Accident Victim.

3. Discuss what each student has demonstrated.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use JS/Treating an Accident Victim to give students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Treating an Accident Victim.

SUMMARY/CLOSURE
In this lesson you have been given an opportunity to demonstrate what type of treatment you should give accident victims.

THE NEXT LESSON IS: Avoidable Conditions and Actions

LESSON PLAN II-5

ELECTRICAL TRADES I

UNIT: Safety

TOPIC: Avoidable Conditions and Actions

ESSENTIAL ELEMENT(S): Common (4); T&I (4)

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to discuss how unsafe conditions and actions may be avoided.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: No special teaching aids are required.

REFERENCES:
Safety for the Industrial Student
Electrical Trades I
Student Information Sheet/Avoidable Conditions and Actions-SM-25
Assignment Sheet/Causes of Industrial Accidents-SM-29

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Focus student's attention on the importance of safety. Discuss how unsafe conditions and actions cause accidents. By the end of the lesson, you will be able to discuss how unsafe conditions and accidents may be avoided.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Avoidable Conditions and Actions as a guide, present information on unsafe conditions and actions.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss in detail unsafe conditions which may be found in the shop.

3. Discuss in detail unsafe actions which may take place in the shop.

4. Discuss the effects of these unsafe conditions and actions.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

5. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use AS/Causes of Industrial Accidents as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Causes of Industrial Accidents and by observing students as they demonstrate safe working practices.

SUMMARY/CLOSURE
In this lesson you have learned that unsafe conditions and actions result in accidents.

THE NEXT LESSON IS: Poor Safety Attitudes - Causes and Detection

LESSON PLAN II-6

ELECTRICAL TRADES I

UNIT: Safety
TOPIC: Poor Safety Attitudes - Causes and Detection
ESSENTIAL ELEMENT(S): Common (4); T&I (4)
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to discuss the relationship of attitudes and safety.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Safety for the Industrial Student
Electrical Trades I
Student Information Sheet/Poor Safety Attitudes - Causes and Detection-SM-31
Assignment Sheet/Safety Attitudes-SM-35

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Focus student's attention on the importance of safety. Discuss that the attitude you have about safety show up in the way you work. By the end of the lesson, you will be able to discuss the relationship of attitudes and safety.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Poor Safety Attitudes - Causes and Detection as a guide, present information regarding attitudes and safety.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss how our attitudes affect the way we work. Have students give examples of how an unsafe attitudes may cause an accidents.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use AS/Safety Attitudes as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Safety Attitudes.

SUMMARY/CLOSURE
In this lesson you have learned that your attitude regarding safety will effect the way you work.

THE NEXT LESSON IS: Safe Work Clothing - Dressing for Personal Protection

LESSON PLAN II-7

ELECTRICAL TRADES I

UNIT: Safety
TOPIC: Safe Work Clothing - Dressing for Personal Protection
ESSENTIAL ELEMENT(S): Common (4); T&I (4)
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to discuss proper safe work clothing.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: Examples of safe work clothing

REFERENCES:
Safety for the Industrial Student
Electrical Trades I
Student Information Sheet/Safe Work Clothing - Dressing for Personal Protection-SM-37
Assignment Sheet/Safe Work Clothing-SM-39

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Focus student's attention on the importance of safety. Discuss how the type of clothing you wear may affect your safety. By the end of the lesson, you will be able to discuss proper safe work cloting.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Safe Work Clothing - Dressing for Personal Safety as a guide, present information on the types of clothing which may be safely worn while working.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Have students look at the clothing they have on. Assist them in determining if the clothing would be safe to wear while working in the shop.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use AS/Safe Work Clothing as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Safe Work Clothing.

SUMMARY/CLOSURE
In this lesson you have learned that the type of clothing you wear may affect your safety. Wearing unsafe clothing and unsafe actions result in accidents.

THE NEXT LESSON IS: Safe Work Clothing

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LESSON PLAN II-8

ELECTRICAL TRADES I

UNIT:	Safety
TOPIC:	Safe Work Clothing
ESSENTIAL ELEMENT(S):	Common (4); T&I (4)
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will select and wear safe work clothing.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	No special materials are required.
TEACHING AIDS:	Listing of jobs for students to choose from, examples of safe work clothing
REFERENCES:	Safety for the Industrial Student Electrical Trades I Student Information Sheet/Safe Work Clothing - Dressing for Personal Protection-SM-37 Job Sheet/Safe Work Clothing-SM-41

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Focus student's attention on the importance of safety. Discuss how each student should know how to select clothing which will be safe for working. By the end of the lesson, you will be able to discuss proper safe work clothing.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Safe Work Clothing - Dressing for Personal Safety as a guide, review the information on the types of clothing which may be safely worn while working.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Provide students an opportunity to complete JS/Safe Work Clothing.

3. Discuss the type of clothing selected by each student and what makes it safe or unsafe.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use JS/Safe Work Clothing to provide students with an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Safe Work Clothing.

SUMMARY/CLOSURE
In this lesson you have have been provided an opportunity to select clothing which is safe to wear while working.

THE NEXT LESSON IS: Eye and Ear Safety - Personal Protective Devices

LESSON PLAN II-9

ELECTRICAL TRADES I

UNIT:	Safety
TOPIC:	Eye and Ear Safety - Personal Protective Devices
ESSENTIAL ELEMENT(S):	Common (4); T&I (4)
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be able to discuss the importance of personal protective devices in relation to eye and ear safety.

TOOLS AND EQUIPMENT:	Display of personal protective equipment, overhead projector
MATERIALS:	No special materials are required.
TEACHING AIDS:	Make transparency from information sheet showing personal protective equipment.
REFERENCES:	Safety for the Industrial Student Electrical Trades I Student Information Sheet/Eye and Ear Safety - Personal Protective Devices-SM-43 Assignment Sheet/Eye and Ear Safety-SM-47

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Focus student's attention on the importance of safety. Discuss the importance of protecting your eyes and ears as you work. By the end of the lesson, you will be able to discuss the importance of personal protective devices in relation to eye and ear safety.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Eye and Ear Safety - Personal Protective Devices as a guide, present information on the types of personal protective devices which may be used to protect your eyes and ears.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Show students examples of various types of eye and ear protection.

3. Demonstrate to the students how each type of protection is used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use AS/Eye and Ear Safety as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Eye and Ear Safety.

SUMMARY/CLOSURE
In this lesson you have learned that it is important that you wear the proper personal protective equipment in order to protect your eyes and ears.

THE NEXT LESSON IS: Eye and Ear Safety - Personal Protective Devices

LESSON PLAN II-10

ELECTRICAL TRADES I

UNIT: Safety

TOPIC: Eye and Ear Safety - Personal Protective Devices

ESSENTIAL ELEMENT(S): Common (4); T&I (4)

TYPE OF LESSON: Cognitive, Psychomotor

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to select and wear personal protective devices.

TOOLS AND EQUIPMENT: Display of personal protective equipment

MATERIALS: List of task to be completed

TEACHING AIDS: No special teaching aids are required.

REFERENCES:
Safety for the Industrial Student
Electrical Trades I
Student Information Sheet/Eye and Ear Safety - Personal Protective Devices-SM-43
Job Sheet/Personal Protective Devices-SM-49

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Focus student's attention on the importance of safety. Review the importance of protecting your eyes and ears as you work. By the end of the lesson, you will be able to select and use personal protective equipment.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Eye and Ear Safety - Personal Protective Devices as a guide, review the information from the previous lesson.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Provide students with the opportunity to complete JS/Personal Protective Devices.

3. Review the correct procedures for using protective devices as needed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use JS/Personal Protective Devices as an application of information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observation of students completing JS/Personal Protective Devices.

SUMMARY/CLOSURE
In this lesson you have been provided the opportunity to apply what you have learned about the importance of wearing the proper personal protective equipment in order to protect your eyes and ears.

THE NEXT LESSON IS: Respiration Hazards - Lung and Skin Protection

LESSON PLAN II-11

ELECTRICAL TRADES I

UNIT: Safety

TOPIC: Respiration Hazards - Lung and Skin Protection

ESSENTIAL ELEMENT(S): Common (4); T&I (4)

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to discuss respiration hazards and the importance of lung and skin protection.

TOOLS AND EQUIPMENT: Display of respirators and mask

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparency from information sheet showing respirators and mask.

REFERENCES:
Safety for the Industrial Student
Electrical Trades I
Student Information Sheet/Respiration Hazards - Lung and Skin Protection-SM-51
Assignment Sheet/Respiration Hazards-SM-55

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Focus student's attention on the importance of safety. Discuss the importance of protecting your lungs and skin as you work. By the end of the lesson, you will be able to discuss the importance of personal protective devices in relation to respiration hazards.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Respiration Hazards - Lung and Skin Protection as a guide, present information on the types of personal protective devices which may be used to protect your lungs and skin.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate the use of various types of respirators and mask.

3. Discuss the long-term importance of using proper protective equipment.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use AS/Respiration Hazards as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Respiration Hazards.

SUMMARY/CLOSURE
In this lesson you have learned that it is important that you wear the proper personal protective equipment in order to protect your lungs and skin.

THE NEXT LESSON IS: Material Handling

LESSON PLAN II-12

ELECTRICAL TRADES I

UNIT:	Safety
TOPIC:	Material Handling
ESSENTIAL ELEMENT(S):	Common (4); T&I (4)
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be able to discuss safety precautions which should be taken when handling material.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	Empty carcboard box
TEACHING AIDS:	Make transparency from information sheet showing correct procedures for lifting an object.
REFERENCES:	Safety for the Industrial Student Electrical Trades I Student Information Sheet/Material Handling-SM-57 Assignment Sheet/Accident Prevention-SM-61

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Focus student's attention on the importance of safety. Discuss the importance of preventing accidents while handling materials. By the end of the lesson, you will be able to discuss safety precautions which should be taken when handling material.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Material Handling as a guide, present information on methods you should use to protect yourself when handling materials.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss the importance of handling materials correctly.

3. Demonstrate correct lifting procedures.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use AS/Accident Prevention as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Accident Prevention.

SUMMARY/CLOSURE
In this lesson you have learned that it is important that you use proper safety precautions when handling material.

THE NEXT LESSON IS: Lifting Correctly

LESSON PLAN II-13

ELECTRICAL TRADES I

UNIT:	Safety
TOPIC:	Material Handling/Lifting Correctly
ESSENTIAL ELEMENT(S):	Common (4); T&I (4)
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will lift an object using correct lifting procedures.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	Empty cardboard box
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	Safety for the Industrial Student Electrical Trades I Student Information Sheet/Material Handling-SM-57 Job Sheet/Lifting Correctly-SM-63

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Focus student's attention on the importance of safety. Discuss the importance of using correct lifting procedues when lifting. By the end of the lesson, you will lift an object using correct lifting procedures.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Material Handling as a guide, review information on methods you should use to protect yourself when lifting materials.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Provide students the opportunity to complete JS/Lifting Correctly.

3. Provide correction as needed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use JS/Lifting Correctly to give students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observation of students as they complete JS/Lifting Correctly.

SUMMARY/CLOSURE
In this lesson you have been given the opportunity to lift an object using correct lifting procedures.

THE NEXT LESSON IS: Safe Use and Care of Hand Tools

LESSON PLAN II-14

ELECTRICAL TRADES I

UNIT: Safety
TOPIC: Safe Use and Care of Hand Tools
ESSENTIAL ELEMENT(S): Common (4); T&I (4)
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to discuss the safe use and care of hand tools.

TOOLS AND EQUIPMENT: Display of hand tools

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparencies from information sheet showing various hand tools.

REFERENCES:
Safety for the Industrial Student
Electrical Trades I
Student Information Sheet/Safe Use and Care of Hand Tools-SM-65
Assignment Sheet/Safe Use and Care of Hand Tools-SM-69

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Focus student's attention on the importance of safety. Discuss the importance of using safety precautions when using and caring for hand tools. By the end of the lesson, you will be able to discuss the safe use and care of hand tools.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Safe Use and Care of Hand Tools as a guide, present information on methods you should use to protect yourself when using hand tools.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the students the proper use and care of hand tools.

3. Discuss the proper safety procedures to follow when using hand tools.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use AS/Safe Use and Care of Hand Tools as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Safe Use and Care of Hand Tools.

SUMMARY/CLOSURE
In this lesson you have learned that it is important that you use proper safety precautions when using hand tools.

THE NEXT LESSON IS: Shop Machines and the Industrial Color Code

LESSON PLAN II-15

ELECTRICAL TRADES I

UNIT: Safety
TOPIC: Shop Machines and the Industrial Color Code
ESSENTIAL ELEMENT(S): Common (4); T&I (4)
TYPE OF LESSON: Cognitive, Psychomotor
UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to discuss shop machines and the industrial color code.

TOOLS AND EQUIPMENT: One or more shop machines

MATERIALS: No special materials are required.

TEACHING AIDS: No special teaching aids are required.

REFERENCES:
Safety for the Industrial Student
Electrical Trades I
Student Information Sheet/Shop Machines and the Industrial Color Code-SM-71
Assignment Sheet/Power Tools and the Industrial Color Code-SM-75

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Focus student's attention on the importance of safety. Discuss the importance of knowing the industrial color code. By the end of the lesson, you will be able to discuss shop machines and the industrial color code.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Shop Machines and the Industrial Color Code as a guide, present information on how industrial color codes are used.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss specifics of safety regarding the use of power tools.

3. Demonstrate correct safety procedures used when working with power tools and machines.

4. Provide students an opportunity to use one shop machine.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

5. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use AS/Power Tools and the Industrial Color Code as independent practice. Provide students with the opportunity to use shop machines safely.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Power Tools and the Industrial Color Code and by observing students as they use shop machines safely.

SUMMARY/CLOSURE
In this lesson you have learned that a knowledge of the industrial color code is important.

THE NEXT LESSON IS: Fire Prevention and Control

LESSON PLAN II-16

ELECTRICAL TRADES I

UNIT:	Safety
TOPIC:	Fire Prevention and Control
ESSENTIAL ELEMENT(S):	Common (4); T&I (4)
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be able to discuss fire prevention and control.

TOOLS AND EQUIPMENT:	Display of various fire extinguishers, overhead projector
MATERIALS:	No special materials are required.
TEACHING AIDS:	Make transparency from information sheet showing various fire extinguishers.
REFERENCES:	Safety for the Industrial Student Electrical Trades I Student Information Sheet/Fire Prevention and Control-SM-77 Assignment Sheet/Fire Prevention and Control-SM-81

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Focus student's attention on the importance of safety. Discuss the importance of fire prevention and control. By the end of the lesson, you will be able to discuss fire prevention and control.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Fire Prevention and Control as a guide, present information on how fires may be prevented and/or controlled.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss the different types of fires. Give examples of each.

3. Show students the different types of fire extinguishers available. Discuss which type of fire extinguisher is used on each different type of fire.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. After discussing the information provided; ask questions requiring individual and group responses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

STUDENT ACTIVITIES (APPLICATION)
Use AS/Fire Prevention and Control as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Fire Prevention and Control.

SUMMARY/CLOSURE
In this lesson you have learned methods which will prevent and/or control fires.

THE NEXT LESSON IS: You will begin a new unit.

UNIT III

INTRODUCTION TO ELECTRICAL TRADES

LESSON PLAN III-1

ELECTRICAL TRADES I

UNIT: Introduction to Electrical Trades
TOPIC: Terms and Definitions
ESSENTIAL ELEMENT(S): Common (2)A, B; (3) A; T&I (2) A, B; (3) A
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate an understanding of the basic concepts associated with electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to define electrical terms.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: Chalkboard

REFERENCES:
General Construction Trades: Electrical
Electrical Trades I
Student Information Sheet/Terms and Definitions-SM-85
Assignment Sheet/Terms and Definitions-SM-87

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
When working in any area, it is important that you know how to use the terms of the trade. Knowing electrical terms will assist you as you work. By the end of the lesson, you will be able to define electrical terms.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Terms and Definitions as a guide, present each term.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Write sentences on the chalkboard using the terms.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Have the students give the correct definitions.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Terms and Definitions as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Terms and Definitions.

SUMMARY/CLOSURE

In this lesson you have been introduced to many of the terms you will use while working in electrical trades. Practice using each one correctly. By knowing the language of the trade, you will be able to work smarter.

THE NEXT LESSON IS: Occupational Outlook

LESSON PLAN III-2

ELECTRICAL TRADES I

UNIT: Introduction to Electrical Trades
TOPIC: Occupational Outlook
ESSENTIAL ELEMENT(S): Common (2)A, B; (3) A; T&I (2) A, B; (3) A
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate an understanding of the basic concepts associated with electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to discuss career opportunities available in the area of electrical trades.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: Proivide outside reading material in the area of occupations.

TEACHING AIDS: You may wish to invite an outside speaker from the area of electrical trades to speak to your class.

REFERENCES:
Electrical Trades I
Student Information Sheet/Occupational Outlook-SM-91
Assignment Sheet/Occupational Outlook-SM-93

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Before you start work in any area, you should find out all you can about the area. By learning about electrical trades, you will be able to make an informed decision about you future. By the end of the lesson, you will be able to discuss career opportunities available in the area of electrical trades.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Occupational Outlook as a guide, present information on careers. You may wish to invite someone from the local area to speak to your class about electrical trades.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Instruct the students to pay careful attention to the speaker and take notes.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to ask questions regarding possible occupations in the area of electrical trades.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Occupational Outlook as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Occupational Outlook.

SUMMARY/CLOSURE
In this lesson you have been introduced to many of the careers which are available to you in the area of electrical trades. By knowing your options, you can make a wise decision regarding your career.

THE NEXT LESSON IS: Related Careers

LESSON PLAN III-3

ELECTRICAL TRADES I

UNIT: Introduction to Electrical Trades

TOPIC: Related Careers

ESSENTIAL ELEMENT(S): Common (2)A, B; (3) A; T&I (2) A, B; (3) A

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate an understanding of the basic concepts associated with electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to list and discuss careers which are related to electrical trades.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: Provide additional reading materials in the area of electrical careers.

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Related Careers-SM-95
Assignment Sheet/Related Careers-SM-97

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

When you first begin studying electrical trades, you may think that the training you are receiving will prepare you for one field, residential electrical trades. By the end of the lesson, you will be able to list and discuss careers which are related to electrical trades.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Related Careers as a guide, present information on different careers which are related to electrical trades.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss in detail related careers and how the skills learned in electrical transfer to other areas.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Provide students with examples of related careers.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Related Careers as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Related Careers.

SUMMARY/CLOSURE
In this lesson you have been introduced to a number of careers you may wish to learn more about. There are many options open to you if you have skills in electrical trades.

THE NEXT LESSON IS: You will begin a new unit.

UNIT IV

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES

LESSON PLAN IV-1

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades
TOPIC: Learning About Pliers
ESSENTIAL ELEMENT(S): T&I (7) A, B, C, D, E
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be familiar with the types of pliers used in electrical trades.

TOOLS AND EQUIPMENT: Display of pliers, overhead projector

MATERIALS: Used electrical outlet boxes, switches, wiring, etc.

TEACHING AIDS: Make transparency masters of drawings of tools shown in the information sheet.

REFERENCES:
Electrical Trades I
Student Information Sheet/Learning About Pliers-SM-101
Assignment Sheet/Learning About Pliers-SM-107

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
There are many different types of tools used in electrical trades. Today we will be studying pliers, the types of pliers, and their uses. By the end of the lesson, you will be familiar with the types of pliers used in electrical trades.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Pliers as a guide, present information regarding the different types of pliers available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how various types of pliers are to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of pliers available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Learning About Pliers as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Learning About Pliers.

SUMMARY/CLOSURE
In this lesson you have learned about the types of pliers used in electrical trades.

THE NEXT LESSON IS: Learning About Pliers

LESSON PLAN IV-2

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades
TOPIC: Learning About Pliers
ESSENTIAL ELEMENT(S): T&I (7) A, B, C, D, E
TYPE OF LESSON: Cognitive, Psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to use pliers.

TOOLS AND EQUIPMENT: Display of pliers prepared by instructor

MATERIALS: Used electrical boxes, switches, wire, etc.

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical TradesI
Student Information Sheet/Learinig About Pliers-SM-101
Job Sheet/Learning About Pliers-SM-109

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have had the opportunity to learn about the different types of pliers used in electrical trades. By the end of the lesson, you will demonstrate the ability to use pliers.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Pliers as a guide, review the information regarding the different types of pliers available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Have students demonstrate to the class how various types of pliers are to be used in order to complete JS/Learning About Pliers.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to ask questions regarding how pliers differ.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Learning About Pliers to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Learning About Pliers.

SUMMARY/CLOSURE

In this lesson you have been given an opportunity to use pliers.

THE NEXT LESSON IS: Learning About Screwdrivers

LESSON PLAN IV-3

ELECTRICAL TRADES I

UNIT:	Tools, Equipment, and Materials for Electrical Trades
TOPIC:	Learning About Screwdrivers
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C, D, E
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be familiar with the types of screwdrivers used in electrical trades.

TOOLS AND EQUIPMENT:	Disply of screwdrivers, overhead projector
MATERIALS:	Used electrical boxes, switches, wire, etc.
TEACHING AIDS:	Make transparency masters of drawings of tools shown in the information sheet.
REFERENCES:	Electrical TradesI Student Information Sheet/Learinig About Screwdrivers-SM-111 Assignment Sheet/Learning About Screwdrivers-SM-115

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

There are many different types of tools used in electrical trades. Today we will be studying screwdrivers, the types of screwdrivers, and their uses. By the end of the lesson, you will be familiar with the types of screwdrivers used in electrical trades.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Screwdrivers as a guide, present information regarding the different types of screwdrivers available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how various types of screwdrivers are to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of screwdrivers available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Learning About Screwdrivers as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Learning About Screwdrivers.

SUMMARY/CLOSURE
In this lesson you have learned about the types of screwdrivers used in electrical trades.

THE NEXT LESSON IS: Learning About Screwdrivers

LESSON PLAN IV-4

ELECTRICAL TRADES I

UNIT:	Tools, Equipment, and Materials for Electrical Trades
TOPIC:	Learning About Screwdrivers
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C, D, E
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to use screwdrivers.

TOOLS AND EQUIPMENT:	Display of screwdrivers prepared by instructor
MATERIALS:	Used electrical boxes, switches, wire, etc.
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	Electrical TradesI Student Information Sheet/Learning About Screwdrivers-SM-111 Job Sheet/Learning About Screwdrivers-SM-117

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have had the opportunity to learn about the different types of screwdrivers used in electrical trades. By the end of the lesson, you will demonstrate the ability to use screwdrivers.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Screwdrivers as a guide, review the information regarding the different types of screwdrivers available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Have students demonstrate to the class how various types of screwdrivers are to be used in order to comlete JS/Learning About Screwdrivers.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to ask questions regarding the different types of screws and their uses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Learning About Screwdrivers to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Learning About Screwdrivers.

SUMMARY/CLOSURE
In this lesson you have been given an opportunity to use screwdrivers.

THE NEXT LESSON IS: Learning About Saws

LESSON PLAN IV-5

ELECTRICAL TRADES I

UNIT:	Tools, Equipment, and Materials for Electrical Trades
TOPIC:	Learning About Saws
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C, D, E
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be familiar with the types of saws used in electrical trades.

TOOLS AND EQUIPMENT:	Display of saws, overhead projector
MATERIALS:	Used conduit and boards
TEACHING AIDS:	Make transparency masters of drawings of tools shown in the information sheet.
REFERENCES:	Electrical TradesI Student Information Sheet/Learning About Saws-SM-119 Assignment Sheet/Learning About Saws-SM-127

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

There are many different types of tools used in electrical trades. Today we will be studying saws, the types of saws, and their uses. By the end of the lesson, you will be familiar with the types of saws used in electrical trades.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Saws as a guide, present information regarding the different types of saws available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how various types of sawa are to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of saws available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Learning About Saws as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Learning About Saws.

SUMMARY/CLOSURE
In this lesson you have learned about the types of saws used in electrical trades.

THE NEXT LESSON IS: Learning About Saws

LESSON PLAN IV-6

ELECTRICAL TRADES I

UNIT:	Tools, Equipment, and Materials for Electrical Trades
TOPIC:	Learning About Saws
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C, D, E
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to use saws.

TOOLS AND EQUIPMENT:	Display of saws prepared by instructor
MATERIALS:	Used conduit and boards
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	Electrical TradesI Student Information Sheet/Learning About Saws-SM-119 Job Sheet/Learning About Saws-SM-129

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have had the opportunity to learn about the different types of saws used in electrical trades. By the end of the lesson, you will demonstrate the ability to use saws.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Saws as a guide, review the information regarding the different types of saws available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Have the students demonstrate to the class how various types of saws are to be used in order to complete JS/Learning About Saws.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to ask questions regarding the various types of saws.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Learning About Saws to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Learning About Saws.

SUMMARY/CLOSURE

In this lesson you have been given an opportunity to use saws.

THE NEXT LESSON IS: Learning About Drilling Tools and Equipment

LESSON PLAN IV-7

ELECTRICAL TRADES I

UNIT:	Tools, Equipment, and Materials for Electrical Trades
TOPIC:	Learning About Drilling Tools and Equipment
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C, D, E
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be familiar with the types of drilling tools and equipment used in electrical trades.

TOOLS AND EQUIPMENT:	Display of drilling tools and equipment, overhead projector
MATERIALS:	Used sheets of metal, boards, etc.
TEACHING AIDS:	Make transparency masters of drawings of tools shown in the information sheet.
REFERENCES:	Electrical TradesI Student Information Sheet/Learning About Drilling Tools and Equipment-SM-131 Assignment Sheet/Learning About Drilling Tools and Equipment-SM-135

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

There are many different types of tools used in electrical trades. Today we will be studying drilling tools and equipment, the types of drilling tools and equipment, and their uses. By the end of the lesson, you will be familiar with the types of drilling tools and equipment used in electrical trades.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Drilling Tools and Equipment as a guide, present information regarding the different types of drilling tools and equipment available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how various types of drilling tools and equipment are to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of drilling tools and equipment available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Learning About Drilling Tools and Equipment as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Learning About Drilling Tools and Equipment.

SUMMARY/CLOSURE
In this lesson you have learned about the types of drilling tools and equipment used in electrical trades.

THE NEXT LESSON IS: Learning About Drilling Tools and Equipment

LESSON PLAN IV-8

ELECTRICAL TRADES I

UNIT:	Tools, Equipment, and Materials for Electrical Trades
TOPIC:	Learning About Drilling Tools and Equipment
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C, D, E
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to use drilling tools and equipment.

TOOLS AND EQUIPMENT:	Display of drilling tools and equipment prepared by instructor
MATERIALS:	Used sheets of metal, boards, etc.
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	Electrical TradesI Student Information Sheet/Learning About Drilling Tools and Equipment-SM-131 Job Sheet/Learning About Drilling Tools and Equipment-SM-137

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

You have had the opportunity to learn about the different types of drilling tools and equipment used in electrical trades. By the end of the lesson, you will demonstrate the ability to use drilling tools and equipment.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Drilling Tools and Equipment as a guide, review the information regarding the different types of drilling tools and equipment available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Have students demonstrate to the class how various types of drilling tools and equipment are to be used in order to complete JS/Learning About Drilling Tools and Equipment.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to ask questions regarding the different drilling tools and equipment available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Learning About Drilling Tools and Equipment to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Learning About Drilling Tools and Equipment.

SUMMARY/CLOSURE

In this lesson you have been given an opportunity to use drilling tools and equipment.

THE NEXT LESSON IS: Learning About Hammers

LESSON PLAN IV-9

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Hammers

ESSENTIAL ELEMENT(S): T&I (7) A, B, C, D, E

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be familiar with the types of hammers used in electrical trades.

TOOLS AND EQUIPMENT: Display of hammers, overhead projector

MATERIALS: Nails, boards, etc.

TEACHING AIDS: Make transparency masters of drawings of tools shown in the information sheet.

REFERENCES: Electrical TradesI
Student Information Sheet/Learining About Hammers-SM-139
Assignment Sheet/Learning About Hammers-SM-145

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
There are many different types of tools used in electrical trades. Today we will be studying hammers, the types of hammers, and their uses. By the end of the lesson, you will be familiar with the types of hammers used in electrical trades.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Hammers as a guide, present information regarding the different types of hammers available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how various types of hammers are to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of hammers available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Learning About Hammers as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Learning About Hammers.

SUMMARY/CLOSURE
In this lesson you have learned about the types of hammers used in electrical trades.

THE NEXT LESSON IS: Learning About Hammers

LESSON PLAN IV-10

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Hammers

ESSENTIAL ELEMENT(S): T&I (7) A, B, C, D, E

TYPE OF LESSON: Cognitive, Psychomotor

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to use hammers.

TOOLS AND EQUIPMENT: Display of hammers prepared by instructor

MATERIALS: Nails, boards, etc.

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical TradesI
Student Information Sheet/Learning About Hammers-SM-139
Job Sheet/Learning About Hammers-SM-147

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

You have had the opportunity to learn about the different types of hammers used in electrical trades. By the end of the lesson, you will demonstrate the ability to use hammers.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Hammers as a guide, review the information regarding the different types of hammers available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Have students demonstrate to the class how various types of hammers are to be used in order to complete JS/Learning About Hammers.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to ask questions regarding the different types of hammers available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Learning About Hammers to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Learning About Hammers.

SUMMARY/CLOSURE
In this lesson you have been given an opportunity to use hammers.

THE NEXT LESSON IS: Learning About Soldering Equipment and Supplies

LESSON PLAN IV-11

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades
TOPIC: Learning About Soldering Equipment and Supplies
ESSENTIAL ELEMENT(S): T&I (7) A, B, C, D, E
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be familiar with the soldering equipment and supplies used in electrical trades.

TOOLS AND EQUIPMENT: Display of soldering equipment and supplies, overhead projector

MATERIALS: Soldering supplies

TEACHING AIDS: Make transparency masters of drawings of tools shown in the information sheet.

REFERENCES: Electrical TradesI
Student Information Sheet/Learning About Soldering Equipment and Supplies-SM-149
Assignment Sheet/Learning About Soldering Equipment and Supplies-SM-153

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

There are many different types of tools used in electrical trades. Today we will be studying soldering equipment and supplies, the types of soldering equipment and supplies, and their uses. By the end of the lesson, you will be familiar with the types of soldering equipment and supplies used in electrical trades.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Soldering Equipment and Supplies as a guide, present information regarding the different types of soldering equipment and supplies available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how various types of soldering equipment and supplies are to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of soldering equipment and supplies available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Learning About Soldering Equipment and Supplies as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Learning About Soldering Equipment and Supplies.

SUMMARY/CLOSURE

In this lesson you have learned about the types of soldering equipment and supplies used in electrical trades.

THE NEXT LESSON IS: Learning About Soldering Equipment and Supplies

LESSON PLAN IV-12

ELECTRICAL TRADES I

UNIT:	Tools, Equipment, and Materials for Electrical Trades
TOPIC:	Learning About Soldering Equipment and Supplies
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C, D, E
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to use soldering equipment.

TOOLS AND EQUIPMENT:	Display of soldering equipment and supplies prepared by instructor
MATERIALS:	Soldering supplies
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	Electrical TradesI Student Information Sheet/Learning About Soldering Equipment and Supplies-SM-149 Job Sheet/Learning About Soldering Equipment and Supplies-SM-155

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

You have had the opportunity to learn about the different types of soldering equipment and supplies used in electrical trades. By the end of the lesson, you will demonstrate the ability to use soldering equipment and supplies.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Soldering Equipment and Supplies as a guide, review the information regarding the different types of soldering equipment and supplies available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Have students demonstrate to the class how various types of soldering equipment and supplies are to be used in order to complete JS/Learning About Soldering Equipment and Supplies.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to ask questions regarding the different types of soldering equipment and supplies available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Learning About Soldering Equipment and Supplies to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Learning About Soldering Equipment and Supplies.

SUMMARY/CLOSURE
In this lesson you have been given an opportunity to use soldering equipment and supplies.

THE NEXT LESSON IS: Learning About Measuring Tools

LESSON PLAN IV-13

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Measuring Tools

ESSENTIAL ELEMENT(S): T&I (7) A, B, C, D, E

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be familiar with measuring tools used in electrical trades.

TOOLS AND EQUIPMENT: Display of measuring tools, overhead projector

MATERIALS: Boards of various lengths, electrical boxes, etc.

TEACHING AIDS: Make transparency masters of drawings of tools shown in the information sheet.

REFERENCES:
Electrical TradesI
Student Information Sheet/Learning About Measuring Tools-SM-157
Assignment Sheet/Learning About Measuring Tools-SM-161

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

There are many different types of tools used in electrical trades. Today we will be studying measuring tools, the types of measuring tools, and their uses. By the end of the lesson, you will be familiar with the types of measuring tools used in electrical trades.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Measuring Tools as a guide, present information regarding the different types of measuring tools available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how various types of measuring tools are to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of measuring tools available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Learning About Measuring Tools as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Learning About Measuring Tools.

SUMMARY/CLOSURE
In this lesson you have learned about the types of measuring tools used in electrical trades.

THE NEXT LESSON IS: Learning About Measuring Tools

LESSON PLAN IV-14

ELECTRICAL TRADES I

UNIT:	Tools, Equipment, and Materials for Electrical Trades
TOPIC:	Learning About Measuring Tools
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C, D, E
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to use a measuring tool.

TOOLS AND EQUIPMENT:	Display of measuring tools prepared by instructor
MATERIALS:	Boards of various lengths, electrical boxes, etc.
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	Electrical TradesI Student Information Sheet/Learning About Measuring Tools-SM-157 Job Sheet/Learning About Measuring Tools-SM-163

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

You have had the opportunity to learn about the different types of measuring tools used in electrical trades. By the end of the lesson, you will demonstrate the ability to use measuring tools.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

Using SIS/Learning About Measuring Tools as a guide, review the information regarding the different types of measuring tools available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Have students demonstrate to the class how various types of measuring tools are to be used in order to complete JS/Learning About Measuring Tools.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to ask questions regarding the different types of measuring tools available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Learning About Measuring Tools to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Learning About Measuring Tools.

SUMMARY/CLOSURE
In this lesson you have been given an opportunity to use measuring tools.

THE NEXT LESSON IS: Learning About Fishing Tools and Materials

LESSON PLAN IV-15

ELECTRICAL TRADES I

UNIT:	Tools, Equipment, and Materials for Electrical Trades
TOPIC:	Learning About Fishing Tools and Materials
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C, D, E
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be familiar with the use of fishing tools and materials used in electrical trades.

TOOLS AND EQUIPMENT:	Display of Fishing Tools and Materials, overhead projector
MATERIALS:	Electrical wire, conduit, practice wall
TEACHING AIDS:	Make transparency masters of drawings of tools shown in the information sheet.
REFERENCES:	Electrical TradesI Student Information Sheet/Learning About Fishing Tools and Materials-SM-165 Assignment Sheet/Learning About Fishing Tools and Materials-SM-169

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

There are many different types of tools used in electrical trades. Today we will be studying fishing tools and materials, the types of fishing tools and materials, and their uses. By the end of the lesson, you will be familiar with the types of fishing tools and materials used in electrical trades.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Fishing Tools and Materials as a guide, present information regarding the different types of fishing tools and materials available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how various types of fishing tools and materials are to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of fishing tools and materials available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Learning About Fishing Tools and Materials as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Learning About Fishing Tools and Materials.

SUMMARY/CLOSURE
In this lesson you have learned about the types of fishing tools and materials used in electrical trades.

THE NEXT LESSON IS: Learning About Fishing Tools and Materials

LESSON PLAN IV-16

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Fishing Tools and Materials

ESSENTIAL ELEMENT(S): T&I (7) A, B, C, D, E

TYPE OF LESSON: Cognitive, Psychomotor

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to use fishing tools and materials.

TOOLS AND EQUIPMENT: Display of fishing tools and materials prepared by instructor

MATERIALS: Electrical wire, conduit, practice wall

TEACHING AIDS: No special teaching aids are required.

REFERENCES:
Electrical TradesI
Student Information Sheet/Learning About Fishing Tools and Materials-SM-165
Job Sheet/Learning About Fishing Tools and Materials-SM-171

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

You have had the opportunity to learn about the different types of fishing tools and materials used in electrical trades. By the end of the lesson, you will demonstrate the ability to use fishing tools and materials.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Fishing Tools and Materials as a guide, review the information regarding the different types of fishing tools and materials available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Have students demonstrate to the class how various types of fishing tools and materials are to be used in order to complete JS/Learning About Fishing Tools and Materials.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to ask questions regarding the different types of fishing tools and materials available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Learning About Fishing Tools and Materials to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Learning About Fishing Tools and Materials.

SUMMARY/CLOSURE
In this lesson you have been given an opportunity to use fishing tools and materials.

THE NEXT LESSON IS: Learning About Conduit and Pipe Tools

LESSON PLAN IV-17

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Conduit and Pipe Tools

ESSENTIAL ELEMENT(S): T&I (7) A, B, C, D, E

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the tools, equipment, and materials used in electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be familiar with the use of conduit and pipe tools used in electrical trades.

TOOLS AND EQUIPMENT: Display of conduit and pipe tools, overhead projector

MATERIALS: Used conduit, pipe, etc.

TEACHING AIDS: Make transparency masters of drawings of tools shown in the information sheet.

REFERENCES: Electrical TradesI
Student Information Sheet/Learning About Conduit and Pipe Tools-SM-173
Assignment Sheet/Learning About Conduit and Pipe Tools-SM-177

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

There are many different types of tools used in electrical trades. Today we will be studying conduit and pipe tools, the types of conduit and pipe tools, and their uses. By the end of the lesson, you will be familiar with the types of conduit and pipe tools used in electrical trades.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Conduit and Pipe Tools as a guide, present information regarding the different types of conduit and pipe tools available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how various types of conduit and pipe tools are to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of conduit and pipe tools available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Learning About Conduit and Pipe Tools as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Learning About Conduit and Pipe Tools.

SUMMARY/CLOSURE

In this lesson you have learned about the types of conduit and pipe tools used in electrical trades.

THE NEXT LESSON IS: Learning About Conduit and Pipe Tools

LESSON PLAN IV-18

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades
TOPIC: Learning About Conduit and Pipe Tools
ESSENTIAL ELEMENT(S): T&I (7) A, B, C, D, E
TYPE OF LESSON: Cognitive, Psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to use conduit or pipe tool.

TOOLS AND EQUIPMENT: Display of conduit and pipe tools prepared by instructor

MATERIALS: Used conduit, pipe, etc.

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Learning About Conduit and Pipe Tools-SM-173
Job Sheet/Learning About Conduit and Pipe Tools-SM-179

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have had the opportunity to learn about the different types of conduit and pipe tools used in electrical trades. By the end of the lesson, you will demonstrate the ability to use conduit and pipe tools.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Conduit and Pipe Tools as a guide, review the information regarding the different types of conduit and pipe tools available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Have students demonstrate to the class how various types of conduit and pipe tools are to be used in order to complete JS/Learning About Conduit and Pipe Tools.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to ask questions regarding the different types of conduit and pipe tools available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Learning About Conduit and Pipe Tools to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Learning About Conduit and Pipe Tools.

SUMMARY/CLOSURE
In this lesson you have been given an opportunity to use conduit and pipe tools.

THE NEXT LESSON IS: Learning About Test Lights and Wood Chisels

LESSON PLAN IV-19

ELECTRICAL TRADES I

UNIT:	Tools, Equipment, and Materials for Electrical Trades
TOPIC:	Learning About Test Lights and Wood Chisels
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C, D, E
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the tools, equipment, and materials used in electrical trades.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be familiar with the use of test lights and wood chisels used in electrical trades.

TOOLS AND EQUIPMENT:	Display of test lights and wood chisels, overhead projector
MATERIALS:	Light sockets, switches, boards, etc.
TEACHING AIDS:	Make transparency masters of drawings of tools shown in the information sheet.
REFERENCES:	Electrical Trades I Student Information Sheet/Learning About Test Lights and Wood Chisels-SM-181 Assignment Sheet/Learning About Test Lights and Wood Chisels-SM-183

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
There are many different types of tools used in electrical trades. Today we will be studying test lights and wood chisels, the types of test lights and wood chisels, and their uses. By the end of the lesson, you will be familiar with the types of test lights and wood chisels used in electrical trades.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Test Lights and Wood Chisels as a guide, present information regarding the different types of test lights and wood chisels available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how various types of test lights and wood chisels are to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of test lights and wood chisels available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Learning About Test Lights and Wood Chisels as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Learning About Test Lights and Wood Chisels.

SUMMARY/CLOSURE
In this lesson you have learned about the types of test lights and wood chisels used in electrical trades.

THE NEXT LESSON IS: Learning About Test Lights and Wood Chisels

LESSON PLAN IV-20

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Test Lights and Wood Chisels

ESSENTIAL ELEMENT(S): T&I (7) A, B, C, D, E

TYPE OF LESSON: Cognitive, Psychomotor

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to use a test light or a wood chisel.

TOOLS AND EQUIPMENT: Display of test lights and wood chisels prepared by instructor

MATERIALS: Light sockets, switches, boards, etc.

TEACHING AIDS: No special teaching aids are required.

REFERENCES:
Electrical TradesI
Student Information Sheet/Learning About Test Lights and Wood Chisels-SM-181
Job Sheet/Learning About Test Lights and Wood Chisels-SM-185

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

You have had the opportunity to learn about the different types of test lights and wood chisels used in electrical trades. By the end of the lesson, you will demonstrate the ability to use test lights and wood chisels.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Test Lights and Wood Chisels as a guide, review the information regarding the different types of test lights and wood chisels available and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Have students demonstrate to the class how various types of test lights and/or wood chisels are to be used in order to complete JS/Learning About Test Lights and Wood Chisels.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to ask questions regarding the different types of test lights and wood chisels available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Learning About Test Lights and Wood Chisels to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Learning About Test Lights and Wood Chisels.

SUMMARY/CLOSURE

In this lesson you have been given an opportunity to use test lights and wood chisels.

THE NEXT LESSON IS: What Materials Are Used by Electricians

LESSON PLAN IV-21

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades
TOPIC: What Materials Are Used by Electricians?
ESSENTIAL ELEMENT(S): T&I (7) A, B, C, D, E
TYPE OF LESSON: Cognitive, Psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the tools, equipment, and materials used in electrical trades.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be familiar with the materials used by electricians.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: Display of electrical materials

TEACHING AIDS: Make transparency masters of drawings of materials shown in the information sheet.

REFERENCES: Electrical TradesI
Student Information Sheet/What Materials are Used By Electricians?-SM-187
Assignment Sheet/What Materials Are Used By Electricians?-SM-191

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
There are many different types of tools used in electrical trades. Today we will be studying materials used by electricians, the types of materials used, and their uses. By the end of the lesson, you will be familiar with the types of materials used by electricians.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/What Materials Are Used by Electricians? as a guide, present information regarding the different types of materials used by electricians and their uses.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how various types of materials are to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of materials available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/What Materials Are Used by Electricians? as independent practice. Provide students with an opportunity to use electrical materials.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/What Materials Are Used by Electricians? and by observing students as they use electrical materials.

SUMMARY/CLOSURE
In this lesson you have learned about the types of materials used by electricians.

THE NEXT LESSON IS: Next we will begin a new unit.

UNIT V

THEORY OF ELECTRICITY

LESSON PLAN V-I

ELECTRICAL TRADES I

UNIT: Theory of Electricity
TOPIC: Basic Electrical Circuits
ESSENTIAL ELEMENT(S): T&I (7) A, C; Core (1) A
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate a basic understanding of the theory of electricity.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to demonstrate an understanding of basic electric theory.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparency from drawings in information sheet.

REFERENCES: Electrical Trades I
Student Information Sheet/Basic Electrical Circuits-SM-195
Assignment Sheet/Basic Electrical Circuits-SM-197

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
When working in electrical trades, it is important that you understand how electrical circuits function and the basic laws that govern them. By the end of the lesson, you will demonstrate an understanding of basic electric theory.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Basic Electrical Circuits as a guide, present information on electrical circuits and how they work.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss the differences between direct current and alternating current.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Show students examples of direct current and alternating current at work.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Basic Electrical Circuits as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Basic Electrical Circuits.

SUMMARY/CLOSURE
In this lesson you have learned the importance of electrical circuits and how they operate.

THE NEXT LESSON IS: Fundamentals of Electricity

LESSON PLAN V-II

ELECTRICAL TRADES I

UNIT: Theory of Electricity
TOPIC: Fundamentals of Electricity
ESSENTIAL ELEMENT(S): T&I (7) A, C; Core (1) A
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate a basic understanding of the theory of electricity.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to:

1. explain what the valence shell is;
2. explain why better conductors have only one electron in their valance shell;
3. explain the relationship of the conductor movement in the magnetic field to the ability of the conductor to induce a current; and
4. explain the relationship of the magnetic field's polarity to that of the induced current.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparencies of the figures in the information sheet.

REFERENCES: Electrical Trades I
Student Information Sheet/Fundamentals of Electricity-SM-199
Assignment Sheet/Fundamentals of Electricity-SM-205

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
In all areas of study, you will find that there is a certain degree of information which is fundamental to that area. By the end of the lesson, you will demonstrate an understanding of the fundamentals of electricity.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Fundamentals of Electricity as a guide, present information regarding the fundamentals of electricity.

2. Show TMs to assist in clarification of instruction.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

3. Discuss the electron theory. Be sure to include information on conductors and insulators.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Make sure your studenst have an understanding of electrical current.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

5. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Fundamentals of Electricity as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Fundamentals of Electricity.

SUMMARY/CLOSURE
In this lesson you have learned the about the basic fundamentals of electricity.

THE NEXT LESSON IS: Generating Electrical Current

LESSON PLAN V-III

ELECTRICAL TRADES I

UNIT: Theory of Electricity

TOPIC: Generating Electrical Current

ESSENTIAL ELEMENT(S): T&I (7) A, C; Core (1) A

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate a basic understanding of the theory of electricity.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to:

1. explain how an electromagnet is made;
2. explain how to increase the induced voltage;
3. explain the quarter cycles of a generator; and
4. name the phase system of power used in the United States.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparencies of the figures in the information sheet.

REFERENCES: Electrical Trades I
Student Information Sheet/Generating Electrical Current-SM-207
Assignment Sheet/Generating Electrical Current-SM-213

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
We have already looked as some of the fundamentals related to electricity. Today we will look at how an electrical current is generated for use. By the end of the lesson, you will demonstrate an understanding of how an electrical current is generated.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Generating Electrical Current as a guide, present information regarding how electrical currents are generated.

2. Show TMs to assist in clarification of instruction.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

3. Discuss how voltage can be increased.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the differences between and amoung single-phase generators, two-phase generators, and three-phase generators.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

5. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Generating Electrical Current as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Generating Electrical Current.

SUMMARY/CLOSURE
In this lesson you have learned about how an electrical current is generated.

THE NEXT LESSON IS: Units of Electrical Measurements

LESSON PLAN V-IV

ELECTRICAL TRADES I

UNIT: Theory of Electricity
TOPIC: Units of Electrical Measurements
ESSENTIAL ELEMENT(S): T&I (7) A, C; Core (1) A
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate a basic understanding of the theory of electricity.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to:

1. name the various units of electrical measurement;
2. list the three factors in Ohm's law; and
3. use Ohm's law to determine voltage, amperage, and resistance.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparencies of the figures in the information sheet.

REFERENCES: Electrical Trades I
Student Information Sheet/Units of Electrical Measurements-SM-215
Assignment Sheet/Units of Electrical Measurements-SM-219

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Have you ever wondered how the power company figures your electric bill each month? How is electricity measured? By the end of the lesson, you will demonstrate an understanding of units of electrical measurements.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Units of Electrical Measurements as a guide, present information regarding how electricity is measured.

2. Show TMs to assist in clarification of instruction.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

3. Discuss the following terms: coulombs, intensity, amperes, resistance, ohm, ampacity.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Demonstrate to the students how Ohm's law is used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

5. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Units of Electrical Measurements as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Units of Electrical Measurements.

SUMMARY/CLOSURE
In this lesson you have learned how electricity is measured.

THE NEXT LESSON IS: Units of Electrical Measurements

UNIT VI

GENERATING AND DISTRIBUTING ELECTRICAL POWER

LESSON PLAN VI-I

ELECTRICAL TRADES I

UNIT: Generating and Distributing Electrical Power
TOPIC: Generating Electricity
ESSENTIAL ELEMENT(S): T&I (7) A, B, C,; Core (1) B
TYPE OF LESSON: Cognitive, Psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate an understanding of the processes of generating and distributing electrical power and the role of the electric utility company.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be familiar with how electricity is generated.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: Balloons, hair brush or comb

TEACHING AIDS: No special teaching aids are required.

REFERENCES:
Electrical Trades I
Student Information Sheet/Generating Electricity-SM-223
Assignment Sheet/Generating Electricity-SM-225

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
In this unit you will learn about how electricity is generated and produced. By the end of the lesson, you will be able familiar with how electricity is generated.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Generating Electricity as a guide, present information regarding the generation of electricity.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss the various ways in which electricity is generated.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Demonstrate various ways of generating electricity.

4. Give students the opportunity to produce electricity by combing or brushing their hair, or by rubbing the balloon against their hair.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

5. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Generating Electricity as independent practice. Provide students with the opportunity to produce static electricity.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Generating Electricity and by observing students as they produce static electricity.

SUMMARY/CLOSURE

In this lesson you have learned about the different methods used to generate electricity.

THE NEXT LESSON IS: Sources of Electrical Power

LESSON PLAN VI-II

ELECTRICAL TRADES I

UNIT: Generating and Distributing Electrical Power

TOPIC: Sources of Electrical Power

ESSENTIAL ELEMENT(S): T&I (7) A, B, C,; Core (1) B

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate an understanding of the processes of generating and distributing electrical power and the role of the electric utility company.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to discuss the sources of electrical power.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparency of drawing in information sheet.

REFERENCES: Electrical Trades I
Student Information Sheet/Sources of Electrical Power-SM-227
Assignment Sheet/Sources of Electrical Power-SM-229

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
We have discussed how electricity is produced; however, do you know how electricity which has been produced gets to the consumer? By the end of the lesson, you will be able to discuss the sources of electrical power.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Sources of Electrical Power as a guide, present information regarding the distribution of electricity.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss the use of transmission lines, distribution lines, and service lines.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Show TM to help promote class discussion.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Sources of Electrical Power as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Sources of Electrical Power.

SUMMARY/CLOSURE

In this lesson you have learned about the different methods used to distribute electricity to the user.

THE NEXT LESSON IS: Uses of Electrical Power

LESSON PLAN VI-III

ELECTRICAL TRADES I

UNIT: Generating and Distributing Electrical Power
TOPIC: Uses of Electrical Power
ESSENTIAL ELEMENT(S): T&I (7) A, B, C,; Core (1) B
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate an understanding of the processes of generating and distributing electrical power and the role of the electric utility company.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to discuss the uses of electrical power.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Chalkboard, make transparencies showing electrical appliances.

REFERENCES: Electrical Trades I/Student Information Sheet and Assignment Sheet/Uses of Electrical Power

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INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You now know how electricity is produced and how it is delivered to the consumer. Have you ever stopped to think about all the uses there are for electricity? By the end of the lesson, you will be able to discuss the uses of electrical power.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Uses of Electrical Power as a guide, give examples of how electricity is used.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Show TMs to promote class discussion.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to name various electrical appliances used every day.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Uses of Electrical Power as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Uses of Electrical Power.

SUMMARY/CLOSURE

In this lesson you have learned a number of ways in which electricity is used. We have also found how important electricity is in our daily lives.

THE NEXT LESSON IS: You will begin a new unit.

UNIT VII

ELECTRICAL CODES

LESSON PLAN VII-I

ELECTRICAL TRADES I

UNIT:	Electrical Codes
TOPIC:	History of the National Electrical Code
ESSENTIAL ELEMENT(S):	T&I (7) A, C; Core (1) C
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to understand, identify, and apply electrical codes regulating residential electrical construction.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be familiar with the history of the National Electrical Code.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	No special materials are required.
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	Electrical Trades I Student Information Sheet/History of the Natioanl Electrical Code-SM-237 Assignment Sheet/History of the National Electrical Code-SM-239

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
In this lesson we will discuss how the National Electrical Code came about. By the end of the lesson, you will be familiar with the history of the National Electrical Code.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/History of the National Electrical Code as a guide, present the background of the *Code* and how it came into being.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss why the *Code* is necessary.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Reinforce the fact that the Code is not a how too manual but is a reference guide for experienced electricians.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/History of the National Electrical Code as independent practice. Provide students with the opportunity to use troubleshooting tools.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/History of the National Electrical Code and by observing students as they use troubleshooting tools.

SUMMARY/CLOSURE
In this lesson you have learned what lead to the establishment of the *Code*. You have also learned about its intended use.

THE NEXT LESSON IS: Using the National Electrical Code

LESSON PLAN VII-II

ELECTRICAL TRADES I

UNIT:	Electrical Codes
TOPIC:	Using the National Electrical Code
ESSENTIAL ELEMENT(S):	T&I (7) A, C; Core (1) C
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to understand, identify, and apply electrical codes regulating residential electrical construction.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to use the National Electrical Code.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	No special materials are required.
TEACHING AIDS:	Copy of the National Electrical Code
REFERENCES:	Electrical Trades I Student Information Sheet/Using the National Electrical Code-SM-241 Assignment Sheet/Using the National Electrical Code-SM-243

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

You have learned how the National Electrical Code came about. Today you will be given an opportunity to use the code. By the end of the lesson, you will demonstrate the ability of use the National Electrical Code.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Using the National Electrical Code as a guide, present information on how the *Code* is used.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how specific information is found.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the *Code*.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Using the National Electrical Code as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Using the National Electrical Code.

SUMMARY/CLOSURE
In this lesson you have been given an opportunity to use the *Code*.

THE NEXT LESSON IS: You will begin a new unit.

UNIT VIII

BLUEPRINTS AND SCHEMATIC DIAGRAMS

LESSON PLAN VIII-I

ELECTRICAL TRADES I

UNIT:	Blueprints and Schematic Diagrams
TOPIC:	What is a Blueprint?
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C; Core (1) D
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will explain what a blueprint is and how it is used.

TOOLS AND EQUIPMENT:	Overhead projector
MATERIALS:	No special materials are required.
TEACHING AIDS:	Samples of blueprints to show the class and/or transparencies of blueprints
REFERENCES:	ElectricalTrades I Student Information Sheet/What is a Blueprint?-SM-247 Assignment Sheet/What is a Blueprint?-SM-249

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Have you ever tried to put together a model car or boat without instructions? It would be difficult; however, building a house without a blueprint would be much more difficult. By the end of the lesson, you will be able to explain what a blueprint is and how it is used.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/What is a Blueprint? as a guide, provide students with information about blueprints and how they are used.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss how blueprints are used in electrical work.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of blueprints used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/What is a Blueprint? as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/What is a Blueprint?

SUMMARY/CLOSURE

In this lesson you have learned the importance of blueprints and how they are used in electrical trades.

THE NEXT LESSON IS: Symbols

LESSON PLAN VIII-II

ELECTRICAL TRADES I

UNIT: Blueprints and Schematic Diagrams
TOPIC: Symbols
ESSENTIAL ELEMENT(S): T&I (7) A, B, C; Core (1) D
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to correctly identify symbols.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparencies of blueprint symbols from information sheet.

REFERENCES: ElectricalTrades I
Student Information Sheet/Symbols-SM-251
Assignment Sheet/Symbols-SM-253

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
How would you go about drawing all of the instructions and devices needed on a blueprint? Would it be difficult for you to know what another person meant by his/her drawing? By the end of the lesson, you will demonstrate the ability to correctly identify symbols.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Symbols as a guide, provide students with information regarding the different symbols used in drawing blueprints.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Give students samples of blueprints with the symbols shown.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to identify the different symbols used and tell what each represents.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Symbols as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Symbols.

SUMMARY/CLOSURE

In this lesson you have learned how to identify symbols used on blueprints and what each one represents.

THE NEXT LESSON IS: Reading a Ruler

LESSON PLAN VIII-III

ELECTRICAL TRADES I

UNIT:	Blueprints and Schematic Diagrams
TOPIC:	Reading a Ruler
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C; Core (1) D
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to read a ruler.

TOOLS AND EQUIPMENT:	Design a display of measuring tools. Provide a ruler for each student. You will also need an overhead projector.
MATERIALS:	No special materials are required.
TEACHING AIDS:	Make transparencies of figures in information sheet.
REFERENCES:	ElectricalTrades I Student Information Sheet/Reading a Ruler-SM-255 Assignment Sheet/Reading a Ruler-SM-259

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
In order to work with blueprints, you must be able to use measuring devices correctly. By the end of the lesson, you will demonstrate the ability to read a ruler.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Reading a Ruler as a guide, provide students with information on how to use a ruler and how measurement is related to blueprints.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Give students an opportunity to examine the different types of measuring instruments available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to measure various items in the classroom.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Reading a Ruler as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Reading a Ruler.

SUMMARY/CLOSURE
In this lesson you have been given an opportunity to use a ruler.

THE NEXT LESSON IS: Blueprint Scale

LESSON PLAN VIII-IV

ELECTRICAL TRADES I

UNIT:	Blueprints and Schematic Diagrams
TOPIC:	Blueprint Scale
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C; Core (1) D
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be able to convert a scaled drawing into actual size.

TOOLS AND EQUIPMENT:	Provide a ruler for each student. You will also need an overhead projector.
MATERIALS:	Sample blueprints for students to use
TEACHING AIDS:	Make transparencies of figures in information sheet.
REFERENCES:	ElectricalTrades I Student Information Sheet/Blueprint Symbols-SM-261 Assignment Sheet/Blueprint Symbols-SM-263

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Now that you have demonstrated the ability to use a ruler, you will have the opportunity to use that skill. By the end of the lesson, you will demonstrate the ability to convert a scaled drawing into actual size.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Blueprint Scale as a guide, provide students with information on how to convert scaled drawings used on blueprints into actual size.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the students how to convert scaled drawings from sample blueprints.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students an opportunity to convert scaled drawings from sample blueprints.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Blueprint Scale as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Blueprint Scale.

SUMMARY/CLOSURE

In this lesson you have been given an opportunity to convert scale drawings to actual size.

THE NEXT LESSON IS: Blueprint Lines

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LESSON PLAN VIII-V

ELECTRICAL TRADES I

UNIT:	Blueprints and Schematic Diagrams
TOPIC:	Blueprint Lines
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C; Core (1) D
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify blueprint lines.

TOOLS AND EQUIPMENT:	Overhead projector
MATERIALS:	Sample blueprints for students to use
TEACHING AIDS:	Chalkboard and transparencies made from figures in information sheet.
REFERENCES:	Electrical Trades I Student Information Sheet/Blueprint Lines-SM-265 Assignment Sheet/Blueprint Lines-SM-269

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

In drawing blueprints there are special lines you use in order to identify different steps and items in the building process. By the end of the lesson, you will demonstrate the ability to identify blueprint lines.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Blueprint Lines as a guide, provide students with information on the different types of blueprint lines and how they are used.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Show students examples of how lines are used on various blueprints.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to identify blueprint lines drawn on the chalkboard.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Blueprint Lines as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Blueprint Lines.

SUMMARY/CLOSURE
In this lesson you have learned how to identify blueprint lines.

THE NEXT LESSON IS: Architect's Plans

LESSON PLAN VIII-VI

ELECTRICAL TRADES I

UNIT:	Blueprints and Schematic Diagrams
TOPIC:	Architect's Plans
ESSENTIAL ELEMENT(S):	T&I (7) A, B, C; Core (1) D
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to list the types of drawings in a complete set of prints.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	Samples blueprints for students to use
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	ElectricalTrades I Student Information Sheet/Architect's Plans-SM-271 Assignment Sheet/Architect's Plans-SM-273

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Blueprints are made up of many types of plans. Today you will study each of the different types of plans used. By the end of the lesson, you will demonstrate the ability to list the types of drawings in a complete sets of prints.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Architect's Plans as a guide, provide students with information on the different types of drawings used to make up a complete set of prints.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Show students examples of the different types of drawings.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of architect's plans.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Architect's Plans as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Architect's Plans.

SUMMARY/CLOSURE

In this lesson you have learned about the different types of drawings which make up a complete set of prints.

THE NEXT LESSON IS: Schematic Diagrams

LESSON PLAN VIII-VII

ELECTRICAL TRADES I

UNIT: Blueprints and Schematic Diagrams

TOPIC: Schematic Diagrams

ESSENTIAL ELEMENT(S): T&I (7) A, B, C; Core (1) D

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify the basic parts of a schematic diagram.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparencies of figures in information sheet.

REFERENCES: ElectricalTrades I
Student Information Sheet/Schematic Diagrams-SM-275
Assignment Sheet/Schematic Diagrams-SM-277

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

In addition to blueprints, electricians also use schematic diagrams. By the end of the lesson, you will demonstrate the ability to identify the basic parts of a schematic diagram.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Schematic Diagram as a guide, provide students with information on schematic diagrams and their various parts.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Show students examples of schematic diagrams and explain how they are used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of schematic diagrams.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Schematic Diagrams as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Schematic Diagrams.

SUMMARY/CLOSURE
In this lesson you have learned to identify the parts of a schematic diagram.

THE NEXT LESSON IS: Types of Schematic Diagrams

LESSON PLAN VIII-VIII

ELECTRICAL TRADES I

UNIT: Blueprints and Schematic Diagrams

TOPIC: Types of Schematic Diagrams

ESSENTIAL ELEMENT(S): T&I (7) A, B, C; Core (1) D

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to distinguish among series, parallel, and complex circuits.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparencies figures in information sheet.

REFERENCES: ElectricalTrades I
Student Information Sheet/Types of Schematic Diagrams-SM-279
Assignment Sheet/Types of Schematic Diagrams-SM-281

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
There are different types of schematic diagrams used. By the end of the lesson, you will demonstrate the ability to distinguish among series, parallel, and complex circuits.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Types of Schematic Diagram as a guide, provide students with information on how schematic diagrams differ.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Show students examples of different types of schematic diagrams.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Have students identify the different types of schematic diagrams from TMs.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Types of Schematic Diagrams as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Types of Schematic Diagrams.

SUMMARY/CLOSURE
In this lesson you have learned to distinguish among series, parallel, and complex circuits.

THE NEXT LESSON IS: You will begin a new unit.

UNIT IX

PLANNING THE JOB

PLANNING
THE JOB

LESSON PLAN IX-1

ELECTRICAL TRADES I

UNIT: Planning the Job
TOPIC: Terms and Definitions for Residential Services
ESSENTIAL ELEMENT(S): T&I (7) A - E; Core (1) E
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to define terms associated with residential services.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: Chalkboard

REFERENCES:
Electrical Trades I
Student Information Sheet/Terms and Definitions for Residential Services-SM-285
Assignment Sheet/Terms and Definitions for Residential Services-SM-287

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

As in other areas of electrical trades, you will find that there are special terms associated with planning a job. By the end of the lesson, the student will be familiar with terms and definitions associated with residential services.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Terms and Definitions for Residential Services as a guide, present terms associated with residential services.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Write each term on the chalkboard and have students discuss each definition.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to use terms correctly in the classroom.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Terms and Definitions for Residential Services as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Terms and Definitions for Residential Services.

SUMMARY/CLOSURE

In this lesson you have learned several of the terms associated with residential services. When installing residential services, it will be importance for you to know these terms.

THE NEXT LESSON IS: Planning Information

LESSON PLAN IX-II

ELECTRICAL TRADES I

UNIT:	Planning the Job
TOPIC:	Planning Information
ESSENTIAL ELEMENT(S):	T&I (7) A - E; Core (1) E
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate an understanding of the types of information you must know in order to plan a residential service entrance.

TOOLS AND EQUIPMENT:	Overhead projector
MATERIALS:	No special materials are required.
TEACHING AIDS:	Samples of blueprints, make transparencies of blueprints
REFERENCES:	Electrical Trades I Student Information Sheet/Planning Information-SM-289

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Before you begin any project it is important that you plan well. Today we will discuss the type of planning needed prior to installing a residential service entrance. By the end of the lesson, the student will be familiar with the type of information needed to plan a residential service entrance.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Use SIS/Planning Information as a guide.

2. Discuss the requirements of installing a residential service entrance.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how various types of pliers are to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Show examples of blueprints to provide additional reinforcement.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Encourage students to discuss the types of information needed. Assist students in determining where the needed information may be obtained.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through listening to student responses as they discuss the types of information needed in order to install a residential service entrance.

SUMMARY/CLOSURE

In this lesson you have identified the types of information you will need before you plan a residential service entrance.

THE NEXT LESSON IS: The Overhead Service

LESSON PLAN IX-III

ELECTRICAL TRADES I

UNIT:	Planning the Job
TOPIC:	The Overhead Service
ESSENTIAL ELEMENT(S):	T&I (7) A - E; Core (1) E
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify parts of an overhead service.

TOOLS AND EQUIPMENT:	Overhead projector
MATERIALS:	No special materials are required.
TEACHING AIDS:	Make a transparencies from the information sheet of the overhead service.
REFERENCES:	Electrical Trades I Student Information Sheet/The Overhead Service-SM-291 Assignment Sheet/Identifying Parts of an Overhead Service-SM-293

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

The residential service entrance may be installed in two ways. You may choose to use an overhead service or a lateral (underground) service. By the end of the lesson, the student will be familiar with the parts of an overhead service.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/The Overhead Service as a guide, discuss the various parts of the overhead service.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Show TMs of the overhead service to promote class discussion.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to identify the parts of the overhead service.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Identifying Parts of an Overhead Service as independent practice. Have students draw a diagram of an overhead service to provide additional reinforcement.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Identifying Parts of an Overhead Service.

SUMMARY/CLOSURE

In this lesson you have learned to recognize the parts of an overhead service.

THE NEXT LESSON IS: Roof Penetration

LESSON PLAN IX-IV

ELECTRICAL TRADES I

UNIT:	Planning the Job
TOPIC:	Roof Penetration
ESSENTIAL ELEMENT(S):	T&I (7) A - E; Core (1) E
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be able to discuss roof penetration.

TOOLS AND EQUIPMENT:	Overhead projector
MATERIALS:	No special materials are required.
TEACHING AIDS:	Make a transparencies of drawings provided on information sheet.
REFERENCES:	Electrical Trades I Student Information Sheet/Roof Penetration-SM-295 Assignment Sheet/Understanding the Process of Roof Penetration-SM-297

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
When you install an overhead service, you must cut a hole through the roof overhang. This is termed roof penetration. By the end of the lesson, the student will be familiar with the process of roof penetration.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Roof Penetration as a guide, discuss the processes involved in roof penetration.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Provide examples of the installation process.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Discuss the importance each step of the installation process.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Understanding the Process of Roof Penetration as independent practice. Have students draw a diagram showing roof penetration to provide additional reinforcement.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Understanding the Process of Roof Penetration.

SUMMARY/CLOSURE

In this lesson you have learned the process of roof penetration and the importance of each step.

THE NEXT LESSON IS: Overhead Service Clearances

LESSON PLAN IX-V

ELECTRICAL TRADES I

UNIT: Planning the Job
TOPIC: Overhead Service Clearances
ESSENTIAL ELEMENT(S): T&I (7) A - E; Core (1) E
TYPE OF LESSON: Cognitive, Psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to discuss clearances of overhead services.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: A copy of the National Electrical Code

REFERENCES:
The National Electrical Code
Electrical Trades I
Student Information Sheet/Overhead Service Clearances-SM-299
Assignment Sheet/Planning an Overhead Service-SM-301

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Have you ever noticed the height of the electrical line running to your house? There are certain codes which determine how high the line must be. By the end of the lesson, the student will be able to discuss clearances of overhead services.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Overhead Service Clearances as a guide, discuss the process for determining how high the clearance must be.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Refer students to the *Code* as needed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the *Code*.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Planning an Overhead Service as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Planning an Overhead Service.

SUMMARY/CLOSURE
In this lesson you have demonstrated the ability to plan an overhead service. You have also learned the importance of overhead service clearances.

THE NEXT LESSON IS: Comparing Service Entrance Methods

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LESSON PLAN IX-VI

ELECTRICAL TRADES I

UNIT: Planning the Job

TOPIC: Comparing Service Entrance Methods

ESSENTIAL ELEMENT(S): T&I (7) A - E; Core (1) E

TYPE OF LESSON: Cognitive, Psychomotor

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to discuss and compare underground and overhead service entrances.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparencies showing different types of service entances.

REFERENCES: Electrical Trades I
Student Information Sheet/Comparing Service Entrance Methods-SM-303
Assignment Sheet/The Underground Service Entrance-SM-305

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
What are the differences between an overhead service entrance and an underground service entrance? By the end of the lesson, the student will be able to discuss the differences between underground and overhead service entrances.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Comparing Service Entrance Methods as a guide, discuss the parts of an underground service entrance and how it differs from the overhead service.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Use TMs to promote class discussion.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Have students identify the parts of the undergound service as shown on the TM.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/The Underground Service Entrance as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/The Underground Service Entrance.

SUMMARY/CLOSURE
In this lesson you have demonstrated the ability to draw and label an underground service entrance. You have also learned the differences between underground and overhead services.

THE NEXT LESSON IS: Types of Circuits

LESSON PLAN IX-VII

ELECTRICAL TRADES I

UNIT:	Planning the Job
TOPIC:	Types of Circuits
ESSENTIAL ELEMENT(S):	T&I (7) A - E; Core (1) E
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate an understanding of various types of circuits.

TOOLS AND EQUIPMENT:	Overhead projector
MATERIALS:	No special materials are required.
TEACHING AIDS:	Make transparencies from drawings in information sheet.
REFERENCES:	Electrical Trades I Student Information Sheet/Types of Circuits-SM-307

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Installation of circuits is a very important part of electrical work. Before you can plan a circuit installation job, you must first understand the different types of circuits used. By the end of the lesson, the student will demonstrate an understanding of the various types of circuits used.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

Using SIS/Types of Circuits as a guide, discuss the different types of circuits and how they differ.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss the use of general purpose circuits.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Discuss the use of small purpose circuits.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Have students study the information sheet. Have students work as a group to figure the number of outlets various sized breakers will support.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through asking questions and discussing calculations made by students.

SUMMARY/CLOSURE

In this lesson you have demonstrated an understanding of various types of circuits used in residential dwellings.

THE NEXT LESSON IS: What Are the Requirements?

LESSON PLAN IX-VIII

ELECTRICAL TRADES I

UNIT: Planning the Job
TOPIC: What Are the Requirements?
ESSENTIAL ELEMENT(S): T&I (7) A - E; Core (1) E
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be familiar with how amperage needs are calculated.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: Chalkboard

REFERENCES: Electrical Trades I/Student Information Sheet/What Are the Requirements?/Assignment Sheet/Figuring Demand Ratings

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Part of planning the job is figuring demand ratings. You will use tables given in the *Code* to assist you in figuring amperage and demand loads. By the end of the lesson, the student will be able to figure general purpose demand ratings.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/What Are the Requirements? as a guide, discuss how amperage is calculated.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Work with students using the *Code* to figure demand ratings for different sized dwellings.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

PLANNING THE JOB

EXTENSION ACTIVITIES

3. Give students the opportunity to figure amperage requirements.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Figuring Demand Ratings as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Figuring Demand Ratings.

SUMMARY/CLOSURE
In this lesson you have demonstrated the ability to calculate demand ratings for various sized dwellings.

THE NEXT LESSON IS: Ranges

LESSON PLAN IX-IX

ELECTRICAL TRADES I

UNIT:	Planning the Job
TOPIC:	Ranges
ESSENTIAL ELEMENT(S):	T&I (7) A - E; Core (1) E
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate an understanding of how to figure the demand load for ranges.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	No special materials are required.
TEACHING AIDS:	Chalkboard
REFERENCES:	Electrical Trades I Student Information Sheet/Ranges-SM-313 Assignment Sheet/Figuring Demand Ratings for Ranges-SM-315

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

One of the special circuits you must learn to figure in planning the job is that of the range. By the end of the lesson, the student will be able to figure demand ratings for ranges.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Ranges as a guide, discuss how demand ratings are calculated for ranges.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Work with students using the *Code* to figure demand ratings for ranges.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to figure demand ratings for ranges.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Figuring Demand Ratings for Ranges as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Figuring Demand Ratings for Ranges.

SUMMARY/CLOSURE
In this lesson you have demonstrated the ability to calculate demand ratings for ranges.

THE NEXT LESSON IS: Dryers and Household Appliances

LESSON PLAN IX-X

ELECTRICAL TRADES I

UNIT:	Planning the Job
TOPIC:	Dryers and Household Appliances
ESSENTIAL ELEMENT(S):	T&I (7) A - E; Core (1) E
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate an understanding of how to figure the demand load for dryers and household appliances

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TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	No special materials are required.
TEACHING AIDS:	Chalkboard
REFERENCES:	The National Electrical Code Electrical Trades I Student Information Sheet/Dryers and Household Appliances-SM-317 Assignment Sheet/Figuring Demand Ratings for Dryers and Household Appliances-SM-319

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

In addition to figuring the demand ratings for ranges, you must also know how to figure the demand ratings for dryers and other household appliances. By the end of the lesson, the student will be able to figure demand ratings for dryers and household appliances.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Dryers and Household Appliances as a guide, discuss how demand ratings are calculated for dryers and household appliances.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Work with students in using the *Code* to figure demand ratings for dryers and household appliances.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to figure demand ratings for dryers and household appliances.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Figuring Demand Ratings for Dryers and Household Appliances as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Figuring Demand Ratings for Dryers and Household Appliances.

SUMMARY/CLOSURE

In this lesson you have demonstrated the ability to calculate demand ratings for dryers and household appliances.

THE NEXT LESSON IS: Water Heaters, Air Conditioners, and Heating Units

LESSON PLAN IX-XI

ELECTRICAL TRADES I

UNIT:	Planning the Job
TOPIC:	Water Heaters, Air Conditioners, and Heating Units
ESSENTIAL ELEMENT(S):	T&I (7) A - E; Core (1) E
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate an understanding of how to figure the demand load for water heaters, air conditioning and heating units.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	No special materials are required.
TEACHING AIDS:	Chalkboard
REFERENCES:	The National Electrical Code Electrical Trades I Student Information Sheet/Water Heaters, Air Conditioning and Heating Units-SM-321

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
We have studied various appliances and how to figure the demand ratings for each. Today you will learn how to figure demand ratings for water heaters, air conditioning and heating units. By the end of the lesson, the student will be able to figure demand ratings for water heaters, air conditioning and heating units.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Water Heaters, Air Conditioning, and Heating Units as a guide, discuss how demand ratings are calculated for water heaters, air conditioning and heating units.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Work with students in using the *Code* to figure demand ratings for water heaters, air conditioners, and heating units.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to figure demand ratings for water heaters, air conditioning units, and heating units.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Give students an opportunity to practice figuring the demand ratings for water heaters, air conditioners, and heating units.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through asking questions and observing students as they practice calculating demand ratings for water heaters, air conditioners, and heating units.

SUMMARY/CLOSURE

In this lesson you have demonstrated the ability to calculate demand ratings for water heaters, air conditioners, and heating units.

THE NEXT LESSON IS: Residential Dwelling Demands

LESSON PLAN IX-XII

ELECTRICAL TRADES I

UNIT:	Planning the Job
TOPIC:	Residential Dwelling Demands
ESSENTIAL ELEMENT(S):	T&I (7) A - E; Core (1) E
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to figure the demand for a residential dwelling.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	No special materials are required.
TEACHING AIDS:	Chalkboard
REFERENCES:	Electrical Trades I Student Information Sheet/Residential Dwelling Demands-SM-323 Assignment Sheet/Figuring Demand Ratings for a Single Family Dwelling-SM-325

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

You have had an opportunity to figure the demand ratings for various sized circuits and appliances. Today we will use what you have learned to figure the demand ratings for a single family dwelling. By the end of the lesson, the student will be able to figure the demand ratings for a residential dwelling.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Residential Dwelling Demands as a guide, discuss how the *Code* is used in figuring the demand ratings for a single family dwelling.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class ratings are figured for various units in residential dwellings.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to figure demand ratings for various units in residential dwellings.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Figuring Demand Ratings for a Single Family Dwelling as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Figuring Demand Ratings for a Single Family Dwelling.

SUMMARY/CLOSURE

In this lesson you have demonstrated the ability to calculate demand ratings for a single family dwelling.

THE NEXT LESSON IS: Next you will begin a new unit.

UNIT X

ELECTRICAL INSTALLATION

LESSON PLAN X-I

ELECTRICAL TRADES I

UNIT:	Electrical Installation
TOPIC:	Terms and Definitions for Electrical Installation
ESSENTIAL ELEMENT(S):	T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify terms and definitions associated with electrical wiring installation.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	No special materials are required.
TEACHING AIDS:	Chalkboard
REFERENCES:	Electrical Trades I Student Information Sheet/Terms and Definitions for Electrical Installation-SM-329 Assignment Sheet/Terms and Definitions for Electrical Installation-SM-331

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
As you have learned in other lessons, the vocabulary used in each area of work is a little different. By the end of the lesson, you will have identified terms and definitions associated with electrical wiring procedures.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Terms and Definitions for Electrical Wiring Procedures as a guide, present the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Write the terms on the chalkboard and have students provide the definition s.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Have students give examples of each term and how it is used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Terms and Definitions for Electrical Installation to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Terms and Definitions for Electrical Installation.

SUMMARY/CLOSURE

In this lesson you have learned the terms and definitions associated with electrical wiring installation.

THE NEXT LESSON IS: Connectors

LESSON PLAN X-II

ELECTRICAL TRADES I

UNIT: Electrical Installation

TOPIC: Connectors

ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install various connectors.

TOOLS AND EQUIPMENT: Display of various types of connectors

MATERIALS: No special materials are required.

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Connectors-SM-333
Assignment Sheet/Connectors-SM-345

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
One part of electrical installation involves connectors. A connector is the connection between wires. By the end of the lesson, you will have demonstrated the ability to identify and properly install various connectors.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Connectors as a guide, present the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Show students each of the different types of connectors used in electrical work.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of connectors and discuss how each is to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Connectors to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Terms and Definitions for Electrical Installation.

SUMMARY/CLOSURE

In this lesson you have learned about connectors and how they are made.

THE NEXT LESSON IS: Connectors/Taped Pigtail

LESSON PLAN X-III

ELECTRICAL TRADES I

UNIT: Electrical Installation

TOPIC: Connectors/Taped Pigtail

ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G

TYPE OF LESSON: Cognitive, psychomotor

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install various connectors.

TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool

MATERIALS: 2 pieces of wire 12 inches in length, electrical tape

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Connectors-SM-333
Job Sheet/Connectors/Taped Pigtail-SM-349

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

You have learned how connectors are used. By the end of the lesson, you will have identified and properly installed a taped pigtail connector.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Connectors as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Reinforce the information in the information by reviewing how each type of connector is to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Review instructions for making a taped pitgail connection.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Connectors/Taped Pigtail to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Connectors/Taped Pigtail.

SUMMARY/CLOSURE

In this lesson you have had the opportunity to install a taped pigtail connector.

THE NEXT LESSON IS: Connectors/Wire Nut Splice

LESSON PLAN X-IV

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Connectors/Wire Nut Splice
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install various connectors.

TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool

MATERIALS: 2 pieces of wire 12 inches in length, wire nut or solderless connector

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Connectors-SM-333
Job Sheet/Connectors/Wire Nut Splice-SM-351

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how connectors are used. By the end of the lesson, you will have identified and properly installed a wire nut splice.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Connectors as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how wire nut splices are made.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice making wire nut splices.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Connectors/Wire Nut Splice to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Connectors/Wire Nut Splice.

SUMMARY/CLOSURE
In this lesson you have had the opportunity to install a wire nut splice.

THE NEXT LESSON IS: Connectors/Multiple-Wire Pigtail Splice

LESSON PLAN X-V

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Connectors/Multiple-Wire Pigtail Splice
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install various connectors.

TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool

MATERIALS: 3 pieces of wire 12 inches in length, wire nut or solderless connector

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Connectors-SM-333
Job Sheet/Connectors/Multiple-Wire Pigtail Splice-SM-353

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how connectors are used. By the end of the lesson, you will have identified and properly installed a multiple-wire pigtail splice.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Connectors as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how multiple-wire pigtail splices are made.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practce making multiple-wire splices.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Connectors/Multiple-Wire Pigtail Splice to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Connectors/Multiple-Wire Pigtail Splice.

SUMMARY/CLOSURE
In this lesson you have had the opportunity to install a multiple-wire pigtail splice.

THE NEXT LESSON IS: Connectors/Western Union Splice

LESSON PLAN X-VI

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Connectors/Western Union Splice
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install various connectors.

TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool

MATERIALS: 2 pieces of wire 12 inches in length, electrical tape

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Connectors-SM-333
Job Sheet/Connectors/Western Union Splice-SM-355

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how connectors are used. By the end of the lesson, you will have identified and properly installed a western union splice.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Connectors as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how western union splices are made.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice making western union splices.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Connectors/Western Union Splice to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Connectors/Western Union Splice.

SUMMARY/CLOSURE

In this lesson you have had the opportunity to install a western union splice.

THE NEXT LESSON IS: Connectors/Tape Western Union Splice

LESSON PLAN X-VII

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Connectors/Tape Western Union Splice
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install various connectors.

TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool

MATERIALS: 2 pieces of wire 12 inches in length, electrical tape

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Connectors-SM-333
Job Sheet/Connectors/Tape Western Union Splice-SM-357

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how connectors are used. By the end of the lesson, you will have identified and properly installed a tape western union splice.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Connectors as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how taped western union splices are made.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice making tape western union splices.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Connectors/Tape Western Union Splice to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Connectors/Tape Western Union Splice.

SUMMARY/CLOSURE
In this lesson you have had the opportunity to install a tape western union splice.

THE NEXT LESSON IS: Connectors/Tee Tap Splice (T-TAP)

LESSON PLAN X-VIII

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Connectors/Tee Tap Splice (T-TAP)
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install various connectors.

TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool

MATERIALS: 2 pieces of no. 14 wire 12 inches in length, electrical tape

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Connectors-SM-333
Job Sheet/Connectors/Tee Tap Splice (T-TAP)-SM-359

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how connectors are used. By the end of the lesson, you will have identified and properly installed a tee tap splice (T-TAP).

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Connectors as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how te tap splices are made.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice making tee tap splices.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Connectors/Tee Tap Splice (T-TAP) to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Connectors/Tee Tap Splice (T-TAP).

SUMMARY/CLOSURE

In this lesson you have had the opportunity to install a tee tap splice.

THE NEXT LESSON IS: Connectors/Crimp-Type

LESSON PLAN X-IX

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Connectors/Crimp-Type
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install various connectors.

TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool, crimping tool

MATERIALS: 2 pieces of wire 12 inches in length, crimping tool

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Connectors-SM-333
Job Sheet/Connectors/Crimp-Type-SM-361

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how connectors are used. By the end of the lesson, you will have identified and properly installed a crimp type splice.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Connectors as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how crimp-type connector are used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice using crimp-type connectors.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Connectors/Crimp-Type to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Connectors/Crimp-Type.

SUMMARY/CLOSURE

In this lesson you have had the opportunity to install a crimp type splice.

THE NEXT LESSON IS: Connectors/Screw Terminals

LESSON PLAN X-X

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Connectors/Screw Terminals
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install various connectors.

TOOLS AND EQUIPMENT: Needle nose pliers, knife, multipurpose tool, screwdriver

MATERIALS: 1 piece of wire 12 inches in length, screw type terminal

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Connectors-SM-333
Job Sheet/Connectors/Screw Terminals-SM-363

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how connectors are used. By the end of the lesson, you will have identified and properly installed a screw type terminal.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Connectors as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how screw terminals are used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice using screw terminal connectors.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Connectors/Screw Terminals to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Connectors/Screw Terminals.

SUMMARY/CLOSURE
In this lesson you have had the opportunity to install a screw type terminal.

THE NEXT LESSON IS: Next you will begin a new unit.

LESSON PLAN X-XI

ELECTRICAL TRADES I

UNIT: Electrical Installation

TOPIC: Learning About Conductors

ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install various conductors.

TOOLS AND EQUIPMENT: Display of various types of conductors

MATERIALS: No special materials are required.

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Learning About Conductors-SM-365
Assignment Sheet/Learning About Conductors-SM-367

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Webster's gives the definition of conductor as "a substance or body capable of transmitting electricity, heat, or sound." By the end of the lesson, you will have identified and properly installed various conductors.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Learning About Conductors as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Show students each type of conductor and discuss how each type is used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of conductors available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Learning About Conductors to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through the scoring of AS/Learing About Conductors.

SUMMARY/CLOSURE
In this lesson you have learned about various conductors and how they are used.

THE NEXT LESSON IS: Conductors/Rigid Metal Conduit

LESSON PLAN X-XII

ELECTRICAL TRADES I

UNIT:	Electrical Installation
TOPIC:	Conductors/Rigid Metal Conduit
ESSENTIAL ELEMENT(S):	T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON:	Cognitive, psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install rigid metal conduit.

TOOLS AND EQUIPMENT:	Hacksaw, pipe threader, reamer, pliers
MATERIALS:	1 foot of rigid conduit, electrical outlet box, locknut and bushing
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	Electrical Trades I Student Information Sheet/Conductors-SM-365 Job Sheet/Conductors/Rigid Metal Conduit-SM-369

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

You have learned how conductors are used. By the end of the lesson, you will have identified and properly installed rigid metal conduit.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Conductors as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how rigid metal conduit is used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice using rigid metal conduit.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Conductors/Rigid Metal Conduit to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Conductors/Rigid Metal Conduit.

SUMMARY/CLOSURE

In this lesson you have had the opportunity to install rigid metal conduit.

THE NEXT LESSON IS: Conductors/Intermediate Metal Conduit

LESSON PLAN X-XIII

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Conductors/Intermediate Metal Conduit
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install intermediate metal conduit.

TOOLS AND EQUIPMENT: Hacksaw, pliers, screwdriver

MATERIALS: 1 foot of intermediate metal conduit, electrical outlet box, connector

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Conductors-SM-365
Job Sheet/Conductors/Intermediate Metal Conduit-SM-371

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how conductors are used. By the end of the lesson, you will have identified and properly installed intermediate metal conduit.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Conductors as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how intermediate metal conduit is used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice using intermediate metal conduit.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Conductors/Intermediate Metal Conduit to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Conductors/Intermediate Metal Conduit.

SUMMARY/CLOSURE

In this lesson you have had the opportunity to install intermediate metal conduit.

THE NEXT LESSON IS: Conductors/Thin-Wall Conduit

LESSON PLAN X-XIV

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Conductors/Thin-Wall Conduit
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install thin-wall conduit.

TOOLS AND EQUIPMENT: Hacksaw, reamer, pliers

MATERIALS: 1 foot of thin-wall conduit, electrical outlet box, pressure coupling

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Conductors-SM-365
Job Sheet/Conductors/Thin-Wall Conduit-SM-373

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how conductors are used. By the end of the lesson, you will have identified and properly installed thin-wall conduit.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Conductors as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how thin-wall conduit is used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice using thin-wall conduit.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Conductors/Thin-Wall Conduit to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Conductors/Thin-Wall Conduit.

SUMMARY/CLOSURE

In this lesson you have had the opportunity to install thin-wall conduit.

THE NEXT LESSON IS: Conductors/Armored Cable

LESSON PLAN X-XV

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Conductors/Armored Cable
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install armored cable.

TOOLS AND EQUIPMENT: Pliers, screwdriver, knife

MATERIALS: 18 inches of armored cable, electrical outlet box, connector

TEACHING AIDS: No special teaching aids are required.

REFERENCES:
Electrical Trades I
Student Information Sheet/Conductors-SM-365
Job Sheet/Conductors/Armored Cable-SM-375

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how conductors are used. By the end of the lesson, you will have identified and properly installed armored cable.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Conductors as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how armored cable is used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice using armored cable.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Conductors/Armored Cable to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Conductors/Armored Cable.

SUMMARY/CLOSURE

In this lesson you have had the opportunity to install armored cable.

THE NEXT LESSON IS: Residential Service Entrance

LESSON PLAN X-XVI

ELECTRICAL TRADES I

UNIT:	Electrical Installation
TOPIC:	Residential Service Entrance
ESSENTIAL ELEMENT(S):	T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install a residential service entrance.

TOOLS AND EQUIPMENT:	Overhead projector
MATERIALS:	No special materials are required.
TEACHING AIDS:	Make transparencies of drawings in information sheet.
REFERENCES:	Electrical Trades I Student Information Sheet/Residential Service Entrance-SM-377 Assignment Sheet/Identify Electrical Service Entrance Parts-SM-379

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Before any electrical energy reaches the consumer, it must first pass through the service entrance. By the end of the lesson, you will have demonstrated the ability to identify and install a residential service entrance.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Residential Service Entrance as a guide, provide information regarding the parts of an electrical service entrance and how it works.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss each part of the service entrance and the role it plays.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Point out each part of the service entrance on the TM and have student tell the role it plays.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Identify Electrical Service Entrance Parts to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of AS/Identify Electrical Service Entrance Parts.

SUMMARY/CLOSURE
In this lesson you have learned the parts of an electrical service entrance and how it works.

THE NEXT LESSON IS: Residential Service Entrance

LESSON PLAN X-XVII

ELECTRICAL TRADES I

UNIT: Electrical Installation

TOPIC: Residential Service Entrance

ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G

TYPE OF LESSON: Cognitive, psychomotor

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install a residential service entrance.

TOOLS AND EQUIPMENT: Hacksaw, screwdriver, pliers, hammer, shovel, multipurpose tool

MATERIALS: Conductor (RHH, THW, THWW, XHHX, RUX, XLP, or RHW), entrance head, meter box, entrance ell

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Residential Service Entrance-SM-377
Job Sheet/Residential Service Entrance-SM-381

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how a service entrance works. By the end of the lesson, you will have identified and properly installed a residential service entrance.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Residential Service Entrance as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how a residential service entrance is installed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the service entrance as it is installed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Residential Service Entrance to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Residnetial Service Entrance.

SUMMARY/CLOSURE

In this lesson you have had the opportunity to install a residential service entrance.

THE NEXT LESSON IS: Power Panels

LESSON PLAN X-XVIII

ELECTRICAL TRADES I

UNIT:	Electrical Installation
TOPIC:	Power Panels
ESSENTIAL ELEMENT(S):	T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON:	Cognitive, psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and install a power panel.

TOOLS AND EQUIPMENT:	Screwdriver, cable cutter or hacksaw, knife, allen wrench 1/4 inch, cable ripper
MATERIALS:	Wiring demonstration panel (provided by instructor), meter base and plank, 7 feet of No. 2/0 three-wire cable, two 1 1/2 inch cable connectors, one 2/0 cable strap.
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	<ins>Electrical Trades I</ins> Student Information Sheet/Residential Service Entrance-SM-377 Job Sheet/Power Panels-SM-383

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned the parts of a service entrance. As you will remember, one of the parts is the power panel. By the end of the lesson, you will have identified and installed a power panel.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Residential Service Entrance as a guide, review the information given.

<ins>CHECK FOR KNOWLEDGE</ins>: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

<ins>RETEACH ACTIVITIES</ins>: Teach the same material using either different methods or employ the technique of individual instruction.

<ins>EXTENSION ACTIVITIES</ins>: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how a power panel is installed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the power panel as it is installed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Power Panels to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Power Panels.

SUMMARY/CLOSURE

In this lesson you have had the opportunity to install a power panel.

THE NEXT LESSON IS: Power Feeder

LESSON PLAN X-XIX

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Power Feeder
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and install a power feeder.

TOOLS AND EQUIPMENT: Knife, wire stripper, screwdriver, rule

MATERIALS: No. 10 three-wire cable with ground, double-pole circuit breaker (30-amp), pencil

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Residential Service Entrance-SM-377
Job Sheet/Power Feeder-SM-385

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
A feeder is a circuit between the service entrance panel and the fuse of a circuit breaker which protects a branch circuit. By the end of the lesson, you will have identified and installed a power feeder.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Residential Service Entrance as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how a power feeder is installed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the power feeder as it is installed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Power Feeder to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Power Feeder.

SUMMARY/CLOSURE

In this lesson you have had the opportunity to install a power feeder.

THE NEXT LESSON IS: Pulling Cable

LESSON PLAN X-XX

ELECTRICAL TRADES I

UNIT:	Electrical Installation
TOPIC:	Pulling Cable
ESSENTIAL ELEMENT(S):	T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate an understanding of how electrical cable is pulled.

TOOLS AND EQUIPMENT:	Overhead projector, drill
MATERIALS:	Practice wall, electrical cable
TEACHING AIDS:	Make transparencies from drawings in information sheet.
REFERENCES:	Electrical Trades I Student Information Sheet/Pulling Cable-SM-387 Assignment Sheet/Pulling Cable-SM-389

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
As in many other areas of electrical work, there are special techniques used to pull electrical cable. By the end of the lesson, you will have demonstrated an understanding of how electrical cable is pulled.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Pulling Cable as a guide, provide students with information on how electrical cable is pulled.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how electrical cable is pulled.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to pull electrical cable.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Pulling Cable to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring AS/Pulling Cable.

SUMMARY/CLOSURE

In this lesson you have learned how electrical cable is pulled.

THE NEXT LESSON IS: Box Identification and Installation

LESSON PLAN X-XXI

ELECTRICAL TRADES I

UNIT:	Electrical Installation
TOPIC:	Box Identification and Installation
ESSENTIAL ELEMENT(S):	T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate an understanding of box identification and installation.

TOOLS AND EQUIPMENT:	Display of various electrical boxes
MATERIALS:	No special materials are required.
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	Electrical Trades I Student Information Sheet/Box Identification and Installation-SM-391 Assignment Sheet/Box Identification and Installation-SM-393

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Device boxes are used to install many different electrical devices. By the end of the lesson, you will have demonstrated an understanding of box identification and installation.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Box Identification and Installation as a guide, provide students with information on the types of electrical boxes used and how they are installed.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Show each type of box to the students as it is discussed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of electrical boxes available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Box Identification and Installation to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring AS/Box Identification and Installation.

SUMMARY/CLOSURE

In this lesson you have learned how to identify and install electrical boxes.

THE NEXT LESSON IS: Mounting Electrical Boxes

LESSON PLAN X-XXII

ELECTRICAL TRADES I

UNIT:	Electrical Installation
TOPIC:	Mounting Electrical Boxes
ESSENTIAL ELEMENT(S):	T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON:	Cognitive, psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to mount electrical boxes.

TOOLS AND EQUIPMENT:	Claw hammer
MATERIALS:	Outlet box, junction box, 16 d box nails
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	Electrical Trades I Student Information Sheet/Box Identification and Installation-SM-391 Job Sheet/Mounting Electrical Boxes-SM-397

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned the types of electrical boxes used and how they are installed. By the end of the lesson, you will have demonstrated the ability to mount electrical boxes.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Box Identification and Installation as a guide, review the information on the types of electrical boxes used and how they are installed.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how electrical boxes are mounted.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice mounting electrical boxes.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Mounting Electrical Boxes to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Mounting Electrical Boxes.

SUMMARY/CLOSURE
In this lesson you have had the opportunity to mount an electrical box.

THE NEXT LESSON IS: Electrical Switch Boxes

LESSON PLAN X-XXIII

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Electrical Switch Boxes
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install electrical switch boxes.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparencies from drawings in information sheet.

REFERENCES: Electrical Trades I
Student Information Sheet/Electrical Switch Boxes-SM-399
Assignment Sheet/Installation of Switches-SM-405

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Electrical switches are installed in device boxes. By the end of the lesson, you will have demonstrated a knowledge of switch installation.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Electrical Switch Boxes as a guide, provide students with information on how electrical switches are installed.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Show TM of electrical switch boxes to the class.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Discuss how switch boxes are installed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Installation of Switches to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring AS/Installation of Switches.

SUMMARY/CLOSURE

In this lesson you have learned how electrical switches are installed.

THE NEXT LESSON IS: Electrical Switch Boxes

LESSON PLAN X-XXIV

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Electrical Switch Boxes
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and install a single pole switch.

TOOLS AND EQUIPMENT: Practice board with empty device box and empty octagon box, single pole switch, light socket, 120v supply line, 120v incadescent bulb, long nose pliers, pocket knife, wire stripper, safety glasses

MATERIALS: 12-2-G or 14-2-G NM cable, wire connectors

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Electrical Switch Boxes-SM-399
Job Sheet/Electrical Switch Boxes-SM-407

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how switch boxes are connected. By the end of the lesson, you will have identified and installed a single pole switch.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Electrical Switch Boxes as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how electriccal switch boxes are installed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice installing electrical switch boxes.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Electrical Switch Boxes to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Electrical Switch Boxes.

SUMMARY/CLOSURE

In this lesson you have had the opportunity to install an electrical switch box.

THE NEXT LESSON IS: Installing a 3-Way Switch

LESSON PLAN X-XXV

ELECTRICAL TRADES I

UNIT: Electrical Installation

TOPIC: Installing a 3-Way Switch

ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G

TYPE OF LESSON: Cognitive, psychomotor

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to install a 3-way switch.

TOOLS AND EQUIPMENT: Utility knife, wire stripper, conventional screwdriver, chain nose or long nose pliers

MATERIALS: 3-way switch, 3 wire NM cable

TEACHING AIDS: No special teaching aids are required.

REFERENCES:
Electrical Trades I
Student Information Sheet/Electrical Switch Boxes-SM-399
Job/Sheet/Installing a 3-Way Switch-SM-411

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how to install a single pole switch. By the end of the lesson, you will have installed a 3-way switch.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Electrical Switch Boxes as a guide, review the information given.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how 3-way switches are installed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice installing 3-way switches.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Installing a 3-Way Switch to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Installing a 3-Way Switch.

SUMMARY/CLOSURE
In this lesson you have had the opportunity to install a 3-way switch.

THE NEXT LESSON IS: Electrical Outlet Boxes

LESSON PLAN X-XXVI

ELECTRICAL TRADES I

UNIT:	Electrical Installation
TOPIC:	Electrical Outlet Boxes
ESSENTIAL ELEMENT(S):	T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and properly install electrical outlet boxes.

TOOLS AND EQUIPMENT:	Overhead projector.
MATERIALS:	No special materials are required.
TEACHING AIDS:	Make transparencies from drawings in information sheet.
REFERENCES:	Electrical Trades I Student Information Sheet/Electrical Outlet Boxes-SM-413 Assignment Sheet/Installation of Receptacles-SM-417

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Electrical outlets are installed in device boxes. By the end of the lesson, you will have demonstrated a knowledge of outlet installation.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Electrical Outlet Boxes as a guide, provide students with information on how electrical outlets are installed.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Use TMs showing various types of electrical outlet boxes.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Discuss how outlet boxes differ and how each type is to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Installation of Receptacles to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring AS/Installation of Receptacles.

SUMMARY/CLOSURE

In this lesson you have learned how electrical outlets are installed.

THE NEXT LESSON IS: Electrical Outlet Boxes

LESSON PLAN X-XXVII

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: Electrical Outlet Boxes
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and install an electrical outlet box.

TOOLS AND EQUIPMENT: Wire stripper, utility knife, conventional screwdriver, long nose pliers

MATERIALS: Duplex receptical

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/Electrical Outlet Boxes-SM-413
Job Sheet/Electrical Outlet Boxes-SM-419

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how electrical outlet boxes are installed. By the end of the lesson, you will have installed an electrical outlet box.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Electrical Outlet Boxes as a guide, review information on how electrical outlets are installed.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how electrical outlet boxes are installed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice installing electrical outlet boxes.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Electrical Outlet Boxes to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Electrical Outlet Boxes.

SUMMARY/CLOSURE
In this lesson you have had the opportunity to install an electrical outlet box.

THE NEXT LESSON IS: Internal Installation

LESSON PLAN X-XXVIII

ELECTRICAL TRADES I

UNIT:	Electrical Installation
TOPIC:	Internal Installation
ESSENTIAL ELEMENT(S):	T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and install internal light fixtures and receptacles.

TOOLS AND EQUIPMENT:	Overhead projector
MATERIALS:	No special materials are required.
TEACHING AIDS:	Make transparencies from drawings in information sheet.
REFERENCES:	Electrical Trades I Student Information Sheet/Internal Installation-SM-421 Assignment Sheet/Identifying Parts of a Flourescent Lamp Fixture-SM-425 Assignment Sheet/Identifying Parts of a Pipe-Supported Lamp Fixture-SM-427

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Internal installation plays a large role in the work of electricians. By the end of the lesson, you will have demonstrated a knowledge of how internal light fixtures and receptacles are installed.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Internal Installation as a guide, provide students with information on how internal fixtures and receptacles are installed.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Point out each part of the flourescent lamp fixture.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Point out each part of the pipe-supported lamp fixture.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Identifying Parts of a Fluorescent Lamp Fixture and Identifying Parts of a Pipe-Supported Lamp Fixture to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring AS/Identifying Parts of a Fluorescent Lamp Fixture and Identifying Parts of a Pipe-Supported Lamp Fixture.

SUMMARY/CLOSURE

In this lesson you have learned how internal fixtures and receptacles are installed.

THE NEXT LESSON IS: Internal Installation

221

LESSON PLAN X-XXIX

ELECTRICAL TRADES I

UNIT:	Electrical Installation
TOPIC:	Internal Installation
ESSENTIAL ELEMENT(S):	T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON:	Cognitive, psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and install an internal light fixture.

TOOLS AND EQUIPMENT:	Wire stripper, screwdriver, pliers
MATERIALS:	Light fixture, wire nuts
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	Electrical Trades I Student Information Sheet/Internal Installation-SM-421 Job Sheet/Internal Installation-SM-429

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

You have learned how internal fixtures are installed. By the end of the lesson, you will have installed an internal fixture.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Internal Installation as a guide, review information on how electrical outlets are installed.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how an internal light fixture is installed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice installing an internal light fixture.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Internal Installation to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Internal Installation.

SUMMARY/CLOSURE
In this lesson you have had the opportunity to install an internal light fixture.

THE NEXT LESSON IS: External Installation

LESSON PLAN X-XXX

ELECTRICAL TRADES I

UNIT:	Electrical Installation
TOPIC:	External Installation
ESSENTIAL ELEMENT(S):	T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and install external light fixtures and receptacles.

TOOLS AND EQUIPMENT:	Overhead projector
MATERIALS:	No special materials are required.
TEACHING AIDS:	Make transparencies from drawings in information sheet.
REFERENCES:	Electrical Trades I Student Information Sheet/External Installation-SM-431 Assignment Sheet /External Installation-SM-433

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

External installation requires different techniques from those used for internal installation. By the end of the lesson, you will have demonstrated a knowledge of how external light fixtures and receptacles are installed.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/External Installation as a guide, provide students with information on how external fixtures and receptacles are installed.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss how external installation differs from internal installation.

CHECK FOR KNOWLEDGE

ELECTRICAL INSTALLATION

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Show TMs to promote class discussion. Give students the opportunity to examine the different types of pliers available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/External Installation to provide students an opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring AS/External Installation.

SUMMARY/CLOSURE

In this lesson you have learned how external fixtures and receptacles are installed.

THE NEXT LESSON IS: External Installation

LESSON PLAN X-XXXI

ELECTRICAL TRADES I

UNIT: Electrical Installation
TOPIC: External Installation
ESSENTIAL ELEMENT(S): T&I (7) A, C, E; Core (1) F, G
TYPE OF LESSON: Cognitive, psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to identify and install an external receptacle.

TOOLS AND EQUIPMENT: Hacksaw, reamer, screwdriver, drill, drill bit, multipurpose tool or knife

MATERIALS: 1 foot of metal conduit, connector, weatherproof housing for receptacle, GFIC, UF or XLP cable, practice wall

TEACHING AIDS: No special teaching aids are required.

REFERENCES: Electrical Trades I
Student Information Sheet/External Installation-SM-431
Job Sheet/External Installation-SM-435

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have learned how external receptacles are installed. By the end of the lesson, you will have installed an external fixture.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/External Installation as a guide, review information on how electrical outlets are installed.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how an external receptacle is installed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to practice installing an external receptacle.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/External Installation to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/External Installation.

SUMMARY/CLOSURE
In this lesson you have had the opportunity to install an external receptacle.

THE NEXT LESSON IS: Next you will begin a new unit.

UNIT XI

TROUBLESHOOTING

LESSON PLAN XI-1

ELECTRICAL TRADES I

UNIT: Troubleshooting

TOPIC: Troubleshooting Tools

ESSENTIAL ELEMENT(S): T&I (7) A - E; Core (1) H

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to troubleshoot residential electrical problems.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to identify tools used in electrical troubleshooting.

TOOLS AND EQUIPMENT: Display of troubleshooting tools provided by instructor, overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparencies of drawings in information sheet.

REFERENCES: Electrical Trades I
Student Information Sheet/Troubleshooting Tools-SM-439
Assignment Sheet/Troubleshooting Tools-SM-441

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
As you have seen in previous units, there are a number of special tools used in electrical trades. By the end of the lesson, you will be able to identify tools used in electrical troubleshooting.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Troubleshooting Tools as a guide, present information on how each tool is used.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Use the tool display or TMs to assist in clarification of understanding.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

TROUBLESHOOTING

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of troubleshooting tools available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Troubleshooting Tools as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of AS/Troubleshooting Tools.

SUMMARY/CLOSURE

In this lesson you have learned about troubleshooting tools and how they are used.

THE NEXT LESSON IS: Electrical Receptacle Troubleshooting

LESSON PLAN XI-II

ELECTRICAL TRADES I

UNIT: Troubleshooting

TOPIC: Electrical Receptacle Troubleshooting

ESSENTIAL ELEMENT(S): T&I (7) A - E; Core (1) H

TYPE OF LESSON: Cognitive, Psychomotor

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to troubleshoot residential electrical problems.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to troubleshoot an electrical receptacle.

TOOLS AND EQUIPMENT: Neon tester, practice box designed by instructor for this exercise

MATERIALS: No special materials are required.

TEACHING AIDS: Additional textbooks from the classroom may be helpful.

REFERENCES: Electrical Trades I
Job Sheet/Electrical Receptacle Troubleshooting-SM-443

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have already discussed troubleshooting tools. By the end of the lesson, you will demonstrate the ability to troubleshoot residential electrical problems.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Electrical Residential Troubleshooting as a guide, present information on how each tool is used.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Use the tool display or TMs to assist in clarification of understanding.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Demonstrate to the students how to troubleshoot electrical receptacles.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Electrical Residential Troubleshooting to provide students the opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Electrical Residential Troubleshooting.

SUMMARY/CLOSURE
In this lesson you have been given the opportunity to troubleshoot an electrical receptacle.

THE NEXT LESSON IS: Troubleshooting Electrical Switches

LESSON PLAN XI-III

ELECTRICAL TRADES I

UNIT: Troubleshooting
TOPIC: Troubleshooting Electrical Switches
ESSENTIAL ELEMENT(S): T&I (7) A - E; Core (1) H
TYPE OF LESSON: Cognitive, Psychomotor
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to troubleshoot residential electrical problems.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to troubleshoot electrical switches.

TOOLS AND EQUIPMENT: Neon tester, practice box designed by instructor for this exercise

MATERIALS: No special materials are required.

TEACHING AIDS: Additional textbooks from the classroom may be helpful.

REFERENCES: Electrical Trades I
Job Sheet/Troubleshooting Electrical Switches-SM-445

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have already discussed troubleshooting tools. By the end of the lesson, you will demonstrate the ability to troubleshoot electrical switches.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Troubleshooting Electrical Switches as a guide, present information on how each tool is used.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Use the tool display or TMs to assist in clarification of understanding.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Demonstrate to students how to troubleshoot electrical switches.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Troubleshooting Electrical Switches to provide students an opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Troubleshooting Electrical Switches.

SUMMARY/CLOSURE
In this lesson you have been given the opportunity to troubleshoot electrical switches.

THE NEXT LESSON IS: Troubleshooting Electrical Fixtures

LESSON PLAN XI-IV

ELECTRICAL TRADES I

UNIT:	Troubleshooting
TOPIC:	Troubleshooting Electrical Fixtures
ESSENTIAL ELEMENT(S):	T&I (7) A - E; Core (1) H
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to troubleshoot residential electrical problems.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to troubleshoot electrical fixtures.

TOOLS AND EQUIPMENT:	Neon tester, practice box designed by instructor for this exercise
MATERIALS:	No special materials are required.
TEACHING AIDS:	Additional textbooks from the classroom may be helpful.
REFERENCES:	Electrical Trades I Job Sheet/Troubleshooting Electrical Fixtures-SM-447

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have already discussed troubleshooting tools. By the end of the lesson, you will demonstrate the ability to troubleshoot electrical fixtures.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Troubleshooting Electrical Fixtures as a guide, present information on how each tool is used.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Use the tool display or TMs to assist in clarification of understanding.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Demonstrate to the students how to troubleshoot electrical fixtures.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Troubleshooting Electrical Fixtures to provide students with the opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Troubleshooting Electrical Fixtures.

SUMMARY/CLOSURE

In this lesson you have been given the opportunity to troubleshoot electrical fixtures.

THE NEXT LESSON IS: Troubleshooting Electrical Breakers

LESSON PLAN XI-V

ELECTRICAL TRADES I

UNIT: Troubleshooting

TOPIC: Troubleshooting Electrical Breakers

ESSENTIAL ELEMENT(S): T&I (7) A - E; Core (1) H

TYPE OF LESSON: Cognitive, Psychomotor

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to troubleshoot residential electrical problems.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will demonstrate the ability to troubleshoot electrical breakers.

TOOLS AND EQUIPMENT: Neon tester, breaker box designed by instructor for this exercise

MATERIALS: No special materials are required.

TEACHING AIDS: Additional textbooks from the classroom may be helpful.

REFERENCES: Electrical Trades I
Job Sheet/Troubleshooting Electrical Breakers-SM-449

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have already discussed troubleshooting tools. By the end of the lesson, you will demonstrate the ability to troubleshoot electrical breakers.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Troubleshooting Electrical Breakers as a guide, present information on how each tool is used.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Use the tool display or TMs to assist in clarification of understanding.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Demonstrate to the students how to troubleshoot electrical breakers.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use JS/Troubleshooting Electrical Breakers to provide students with the opportunity to apply information.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through observing students as they complete JS/Troubleshooting Electrical Breakers.

SUMMARY/CLOSURE

In this lesson you have been given the opportunity to troubleshoot electrical breakers.

THE NEXT LESSON IS: Troubleshooting Electrical Fuses

LESSON PLAN XI-VI

ELECTRICAL TRADES I

UNIT:	Troubleshooting
TOPIC:	Troubleshooting Electrical Fuses
ESSENTIAL ELEMENT(S):	T&I (7) A - E; Core (1) H
TYPE OF LESSON:	Cognitive, Psychomotor
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to troubleshoot residential electrical problems.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will demonstrate the ability to troubleshoot electrical fuses.

TOOLS AND EQUIPMENT:	VOM, neon tester, fuse box designed by instructor for this exercise
MATERIALS:	No special materials are required.
TEACHING AIDS:	Additional textbooks from the classroom may be helpful.
REFERENCES:	Electrical Trades I Job Sheet/Troubleshooting Electrical Fuses-SM-451

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You have already discussed troubleshooting tools. By the end of the lesson you will demonstrate the ability to troubleshoot electrical fuses.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Troubleshooting Electrical Fuses as a guide, present information on how each tool is used.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Use the tool display or TMs to assist in clarification of understanding.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Demonstrate to the students how to troubleshoot electrical fuses.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use JS/Troubleshooting Electrical Fuses to provide students with the opportunity to apply information.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through observing students as they complete JS/Troubleshooting Electrical Fuses.

SUMMARY/CLOSURE
In this lesson you have been given the opportunity to troubleshoot electrical fuses.

THE NEXT LESSON IS: Next you will begin a new unit.

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UNIT XII

COMMON ESSENTIAL ELEMENTS

LESSON PLAN XII-1

ELECTRICAL TRADES I

UNIT:	Common Essential Elements/Leadership
TOPIC:	Leadership Terms and Definitions
ESSENTIAL ELEMENT(S):	Common (1); T&I (1)
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of leadership concepts and skills.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be able to identify terms and definitions associated with leadership.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	No special materials are required.
TEACHING AIDS:	Chalkboard
REFERENCES:	General Construction Trades: Introduction Electrical Trades I Student Information Sheet/Leadership Terms and Definitions-SM-455 Assignment Sheet/Leadership Terms and Definitions-SM-457

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Discuss that when learning about any area of education it is important to know the terms and definitions associated with that area. By the end of the lesson, you will be able to identify terms and definitions associated with leadership.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Leadership Terms and Definitions as a guide, discuss each of the terms and their meaning.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Write terms on the chalkboard. Have students give the correct definition.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to correctly use the terms in class.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Leadership Terms and Definitions as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of assignment sheet.

SUMMARY/CLOSURE
Review several of the terms discussed in the lesson. Have students give the meanings.

THE NEXT LESSON IS:

LESSON PLAN XII-II

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Leadership

TOPIC: Parliamentary Procedures

ESSENTIAL ELEMENT(S): Common (1); T&I (1)

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of leadership concepts and skills.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to demonstrate an understanding of parliamentary procedures.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparency showing Essentials of a Good Meeting.

REFERENCES:
General Construction Trades: Introduction
Electrical Trades I
Student Information Sheet/Parliamentary Procedures-SM-459
Assignment Sheet/Planning and Conducting a Meeting-SM-463

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
You may not think that you will ever be called on to conduct a meeting. However, it is a good idea to know how a meeting should be conducted. By the end of the lesson, you will be able to demonstrate an understanding of parliamentary procedures.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Parliamentary Procedures as a guide, discuss the steps taken when conducting a meeting.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Use the TM showing the essentials of a good meeting to promote class discussion.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to use parliamentary procedures in class.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Planning and Conducting a Meeting to reinforce this area of instruction.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done by observing participation in assignment.

SUMMARY/CLOSURE
Review the main points of the lesson.

THE NEXT LESSON IS:

LESSON PLAN XII-III

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Employment
TOPIC: Employment Terms and Definitions
ESSENTIAL ELEMENT(S): Common (2); T&I (2)
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills related to successful employment and/or postsecondary training.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to identify terms and definitions associated with employment and/or postsecondary training.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: Chalkboard

REFERENCES:
General Construction Trades: Introduction
Electrical Trades I
Student Information Sheet/Employment Terms and Definitions-SM-465
Assignment Sheet/Employment Terms and Definitions-SM-469

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Discuss that when learning about any area of education it is important to know the terms and definitions associated with that area. By the end of the lesson, you will be able to identify terms and definitions associated with employment.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Employment Terms and Definitions as a guide, discuss each of the terms and their meaning.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. List the terms on the chalkboard. Ask students to provide the correct definitions.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to use the terms correctly in class.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Employment Terms and Definitions as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of assignment sheet.

SUMMARY/CLOSURE

Review several of the terms discussed in the lesson. Have students give the meanings.

THE NEXT LESSON IS:

LESSON PLAN XII-IV

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Entrepreneurship
TOPIC: Entrepreneurship Terms and Definitions
ESSENTIAL ELEMENT(S): Common (3); T&I (3)
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills associated with entrepreneurship.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to identify terms and definitions associated with entrepreneurship.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: Chalkboard

REFERENCES:
General Construction Trades: Introduction
Electrical Trades I
Student Information Sheet/Entrepreneurship Terms and Definitions-SM-471
Assignment Sheet/Entrepreneurship Terms and Definitions-SM-473

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Discuss that when learning about any area of education it is important to know the terms and definitions associated with that area. By the end of the lesson, you will be able to identify terms and definitions associated with entrepreneurship.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Entrepreneurship Terms and Definitions as a guide, discuss each of the terms and their meaning.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. List the terms on the chalkboard. Have students provide the correct definitions.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to use the terms correctly in classe.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Entrepreneurship Terms and Definitions as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of assignment sheet.

SUMMARY/CLOSURE

Review several of the terms discussed in the lesson. Have students give the meanings.

THE NEXT LESSON IS:

LESSON PLAN XII-V

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Entrepreneurship

TOPIC: What Is Entrepreneurship?

ESSENTIAL ELEMENT(S): Common (3); T&I (3)

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills associated with entrepreneurship.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to demonstrate an understanding of entrepreneurship.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: Chalkboard

REFERENCES:
General Construction Trades: Introduction
Electrical Trades I
Student Information Sheet/What Is Entrepreneurship?-SM-475
Assignment Sheet/Am I an Entrepreneur?-SM-477

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Discuss the meaning of entrepreneurship. Ask students go give examples of people they know who are entrepreneurs. By the end of the lesson, you will be able to demonstrate an understanding of entrepreneurship.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/What Is Entrepreneurship? as a guide, discuss what type of person might become an entrepreneur.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Reinforce the idea that any one who really wants to can become an entrepreneur.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to discuss what type of business they would like to have.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Am I an Entrepreneur? as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through checking assignment sheet.

SUMMARY/CLOSURE
Review the main points of the lesson.

THE NEXT LESSON IS:

LESSON PLAN XII-VI

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Entrepreneurship
TOPIC: Getting Started
ESSENTIAL ELEMENT(S): Common (3); T&I (3)
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills associated with entrepreneurship.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to demonstrate an understanding of how to start a business.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: Chalkboard

REFERENCES:
General Construction Trades: Introduction
Electrical Trades I
Student Information Sheet/Getting Started-SM-481
Assignment Sheet/Starting Your Own Business-SM-483

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Ask the students if they think it would be difficult to start a business. Have them discuss what they think an individual would need to know when starting a business. By the end of the lesson, you will be able to demonstrate an understanding of how to start a business.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Getting Started as a guide, discuss what you would need to know to start your own business.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. List on the chalkboard some of the things you would need to know in order to start your own business.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give examples of how you would go about starting your own business.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Starting Your Own Business as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through viewing student's participation in assignment.

SUMMARY/CLOSURE

Review the main points of the lesson.

THE NEXT LESSON IS:

LESSON PLAN XII-VII

ELECTRICAL TRADES I

UNIT: Common Essential Elements/General Shop Safety
TOPIC: Personal and Group Safety
ESSENTIAL ELEMENT(S): Common (4); T&I (4)
TYPE OF LESSON: Cognitive
UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to identify safe working practices.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: No special teaching aids are required.

REFERENCES:
General Construction Trades: Introduction
Electrical Trades I
Student Information Sheet/Personal and Group Safety-SM-485
Assignment Sheet/Personal and Group Safety-SM-487

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Discuss that safety is important in that safety affects everyone. Individual safety is a part of overall group safety. By the end of the lesson, you will be able to identify safe working practices.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Personal and Group Safety as a guide, discuss safety practices.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Reinforce the idea that each student is a part of the group and anything one student does will affect others.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to give examples of group safety.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Personal and Group Safety as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of assignment sheet.

SUMMARY/CLOSURE

Review the main points of the lesson.

THE NEXT LESSON IS:

LESSON PLAN XII-VIII

ELECTRICAL TRADES I

UNIT: Common Essential Elements/General Shop Safety

TOPIC: Work Safety in the Shop

ESSENTIAL ELEMENT(S): Common (4); T&I (4)

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to demonstrate a knowledge of safe working practices.

TOOLS AND EQUIPMENT: Overhead projector

MATERIALS: No special materials are required.

TEACHING AIDS: Make transparency of Safety Commandments from information sheet.

REFERENCES:
General Construction Trades: Introduction
Electrical Trades I
Student Information Sheet/Work Safety in the Shop-SM-489
Assignment Sheet/Work Safety in the Shop-SM-491

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Discuss that safety is important in that safety affects everyone. Accidents often happen in the shop. Each student must learn to follow safety procedures in order to protect his/herself and others. By the end of the lesson, you will be able to demonstrate a knowledge of safe working practices.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Work Safety in the Shop as a guide, discuss safety practices.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Ask each student to read one safety commandment aloud and discuss it.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to list additional safety commandments they may think of.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Work Safety in the Shop as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of assignment sheet.

SUMMARY/CLOSURE

Review the main points of the lesson.

THE NEXT LESSON IS:

LESSON PLAN XII-IX

ELECTRICAL TRADES I

UNIT:	Common Essential Elements/General Shop Safety
TOPIC:	Fire Safety
ESSENTIAL ELEMENT(S):	Common (4); T&I (4)
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be able to demonstrate a knowledge of fire safety.

TOOLS AND EQUIPMENT:	Overhead projector, various types of fire extinguishers
MATERIALS:	No special materials are required.
TEACHING AIDS:	Make transparency showing various types of fire extinguishers.
REFERENCES:	General Construction Trades: Introduction Electrical Trades I Student Information Sheet/Fire Safety-SM-493 Assignment Sheet/Fire Safety-SM-495

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)

Fire safety is an important aspect of general shop safety. Being prepared is an important part of being safe. By the end of the lesson, you will be able to demonstrate a knowledge of fire safety.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Fire Safety as a guide, discuss safety practices.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how various types of fire extinguishers are to be used.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of fire extinguishers available.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)

Use AS/Fire Safety as independent practice.

EVALUATION/VERIFICATION

An informal evaluation of student learning may be done through scoring of assignment sheet.

SUMMARY/CLOSURE

Review the main points of the lesson.

THE NEXT LESSON IS:

LESSON PLAN XII-X

ELECTRICAL TRADES I

UNIT: Common Essential Elements/General Shop Safety

TOPIC: Safety with Hand and Power Tools

ESSENTIAL ELEMENT(S): Common (4); T&I (4)

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to demonstrate skills in working safely and apply safety to the use of hand and power tools.

TOOLS AND EQUIPMENT: Prepare a display of tools.

MATERIALS: No special materials are required.

TEACHING AIDS: No special teaching aids are required.

REFERENCES:
General Construction Trades: Introduction
Electrical Trades I
Student Information Sheet/Safety with Hand and Power Tools-SM-497
Assignment Sheet/Safety with Hand and Power Tools-SM-499

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
All aspects of safety are important. However, when working with hand or power tools there are specific safety practices which should be observed. By the end of the lesson, you will be able to demonstrate skills in working safely and apply safety to the use of hand and power tools.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Safety with Hand and Power Tools as a guide, discuss safety practices to be used when working with any type of tool.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class the correct safety procedures to use when working with hand and power tools.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to examine the different types of hand and power tools you have discussed.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Safety with Hand and Power Tools as practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of assignment sheet.

SUMMARY/CLOSURE
Review the main points of the lesson.

THE NEXT LESSON IS:

LESSON PLAN XII-XI

ELECTRICAL TRADES I

UNIT:	Common Essential Elements/Human Relations and Personality Development
TOPIC:	Terms and Definitions for Human Relations and Personality Development
ESSENTIAL ELEMENT(S):	Common (5); T&I (5)
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate an understanding of the concepts and skills associated with human relations and personality development.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be able to identify terms and definitions associated with human relations and personality development.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	No special materials are required.
TEACHING AIDS:	Chalkboard
REFERENCES:	Self-Appraisal Instructional Guide Electrical Trades I Student Information Sheet/Terms and Definitions for Human Relations and Personality Development-SM-501 Assignment Sheet/Terms and Definitions for Human Relations and Personality Development-SM-503

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Discuss that when learning about any area of education it is important to know the terms and definitions associated with that area. By the end of the lesson, you will be able to identify terms and definitions associated with human relations and personality development.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Terms and Definitions for Human Relations and Personality Development as a guide, discuss each of the terms and their meaning.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Write each of the terms on the chalkboard and have students provide the correct definitions.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to use the terms correctly in class.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Terms and Definitions for Human Relations and Personality Development as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of assignment sheet.

SUMMARY/CLOSURE
Review several of the terms discussed in the lesson. Have students give the meanings.

THE NEXT LESSON IS:

LESSON PLAN XII-XII

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Human Relations and Personality Development

TOPIC: Getting to Know Yourself

ESSENTIAL ELEMENT(S): Common (5); T&I (5)

TYPE OF LESSON: Cognitive

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of the concepts and skills associated with human relations and personality development.

SPECIFIC OBJECTIVE(S): Upon completion of this instructional unit, the student(s) will be able to demonstrate an understanding of the importance of getting to know him/herself.

TOOLS AND EQUIPMENT: No special tools or equipment are required.

MATERIALS: No special materials are required.

TEACHING AIDS: No special teaching aids are required.

REFERENCES:
Self-Appraisal Instructional Guide
Electrical Trades I
Student Information Sheet/Getting to Know Yourself-SM-505
Assignment Sheet/Self-Concept Checklist-SM-507

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
How well do you think you know yourself? Do you think that the better you understand yourself, the better you will understand others? By the end of the lesson, you will be able to demonstrate an understanding of the importance of getting to know yourself.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Getting to Know Yourself as a guide, discuss information provided.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Discuss the importance of learning about yourself.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity discuss what they think makes them unique.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Self-Concept Checklist as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through checking assignment sheets.

SUMMARY/CLOSURE
Review the main points of the lesson.

THE NEXT LESSON IS:

LESSON PLAN XII-XIII

ELECTRICAL TRADES I

UNIT:	Common Essential Elements/Personal and Business Management
TOPIC:	Terms and Definitions for Personal and Business Management
ESSENTIAL ELEMENT(S):	Common (6); T&I (6)
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate an understanding of the concepts and skills related to personal and business management.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be able to identify terms and definitions associated with personal and business management.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	No special materials are required.
TEACHING AIDS:	No special teaching aids are required.
REFERENCES:	Economic and Societal Factors Instructional Guide Electrical Trades I Student Information Sheet/Terms and Definitions for Personal and Business Management-SM-509 Assignment Sheet/Terms and Definitions for Personal and Business Management-SM-511

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Discuss that when learning about any area of education it is important to know the terms and definitions associated with that area. By the end of the lesson, you will be able to identify terms and definitions associated with personal and business management.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Terms and Definitions for Personal and Business Management as a guide, discuss each of the terms and their meaning.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Write each term on the chalk and have students provide the correct definition.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Give students the opportunity to use the terms correctly in class.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Terms and Definitions for Personal and Business Management as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through scoring of assignment sheet.

SUMMARY/CLOSURE
Review several of the terms discussed in the lesson. Have students give the meanings.

THE NEXT LESSON IS:

LESSON PLAN XII-XIV

ELECTRICAL TRADES I

UNIT:	Common Essential Elements/Personal and Business Management
TOPIC:	Budgets
ESSENTIAL ELEMENT(S):	Common (6); T&I (6)
TYPE OF LESSON:	Cognitive
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate an understanding of the concepts and skills related to personal and business management.
SPECIFIC OBJECTIVE(S):	Upon completion of this instructional unit, the student(s) will be able to demonstrate an understanding of budgets and how they work.

TOOLS AND EQUIPMENT:	No special tools or equipment are required.
MATERIALS:	No special materials are required.
TEACHING AIDS:	Examples of budgets
REFERENCES:	Economic and Societal Factors Instructional Guide Electrical Trades I Student Information Sheet/Budgets-SM-513 Assignment Sheet/Budgets-SM-515

INTRODUCTION/MOTIVATION/WARM-UP (FOCUS/DIRECT STUDENT'S ATTENTION TO THE CONTENT/PURPOSE OF INSTRUCTION/ACTIVITY)
Ask students if they always have enough money. Are they always able to buy what they would like? If given a plan which would allow them to purchase what they feel they need, would they use it? By the end of the lesson, you will be able to demonstrate an understanding of budgets and how they work.

TEACHER ACTIVITIES (PRESENTATION, DEMONSTRATION, LECTURE, MODELING, AUDIO/VISUALS, CHECK FOR KNOWLEDGE, AND RETEACH/EXTENSION)

1. Using SIS/Budgets as a guide, discuss the parts of a budget and how to plan a budget.

CHECK FOR KNOWLEDGE: Make sure the students are following or comprehending what is being presented. If the students are not perceiving the subject matter, then use reteach activities. If the students are perceiving the subject matter, then use extension activities.

RETEACH ACTIVITIES: Teach the same material using either different methods or employ the technique of individual instruction.

EXTENSION ACTIVITIES: Extend the learning for the student(s). This could be continuing to the next sub-topic or using related magazines, books, pictures, computer software, videos, etc.

2. Demonstrate to the class how to develop a personal budget.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

3. Show students examples of budgets.

CHECK FOR KNOWLEDGE

RETEACH ACTIVITIES

EXTENSION ACTIVITIES

4. Discuss the information provided; ask questions requiring individual and group responses.

STUDENT ACTIVITIES (APPLICATION)
Use AS/Budgets as independent practice.

EVALUATION/VERIFICATION
An informal evaluation of student learning may be done through checking work on assignment sheet.

SUMMARY/CLOSURE
Review the main points of the lesson.

THE NEXT LESSON IS:

APPENDICES

APPENDIX A

MODIFICATION TECHNIQUES FOR SPECIAL POPULATIONS

ACKNOWLEDGEMENT

The Module 7 Overview of the Vocational Special Needs Teacher Training Curriculum has been reprinted with permission as this appendix. Teachers are encouraged to refer to the original publication to learn more about working with special needs populations. The character font size and line spacing have been changed in this appendix to save space.

The project was developed in 1987 by Craig R. Colby, Ed.D. of Texas A&M University. Linda H. Parrish, Ph.D., Texas A&M University, and Jerry L. Wircenski, Ph.D., North Texas State University, were the project directors.

The vocational special needs teacher training curriculum was developed pursuant to a contract with the Texas Education Agency's Vocational Education Special Projects. Contractors or grantees undertaking such projects under Agency sponsorship are encouraged to freely express their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Texas Education Agency position or policy.

This information is presented as an appendix to help Trade and Industrial teachers with planning the modification of instruction for special populations. Many of the concepts and ideas presented are sound practices to be used with normal populations.

The entire 10 module training curriculum is available through the University of Texas at Austin. The modules in the vocational special needs teacher training curriculum are as follows:

Module 1	How to Use the Modules
Module 2	Federal Legislation
Module 3	Learner Characteristics
Module 4	Vocational Assessment
Module 5	Coordinated Planning
Module 6	Interagency Cooperation
Module 7	Modifications
Module 8	Generalizable Skills
Module 9	Serving LEP Students
Module 10	Student Evaluations

CURRICULUM MODIFICATION

The term "vocational curriculum" can be defined as the organized content of a particular discipline which a student must master to attain an occupational goal. It involves the sum total of all experiences and learning activities encountered in the classroom. A curriculum is concerned with results. It encompasses "what is to be taught" and "what is to be learned" (Stern-Otazo, 1980; Goh & Stitlington, 1983).

As discussed in previous modules, each student has a mental capacity, physical skills, and various needs which vary from one individual to the other. In addition, students exhibit different learning styles. All good teachers recognize this and will work toward developing a classroom environment which is characterized by a deep respect for the learner, acceptance of student, fulfillment of individual needs, and individual development. This is what is meant by the teacher who has become "learner-centered" and not "content-centered" (Pine & Boy, 1977). Jones (1977) eloquently describes recognizing individual worth and individual development as being the basis for curriculum development as follows:

> **Individual development** as a basis for curriculum perspective would lead us to teach discovery of principles and sacredness of the individual personality. It would teach the learners to view themselves as self-actualizing individuals in a setting designed to support and encourage personal development to the ultimate of one's potential. Attempts to improve the local community would center around providing a richer and fuller life for personal growth and development. Good people make good communities, good states, good nations, and good world. By emphasizing development of individuals, such a curriculum would hope to plant the seed for a better world in the future.

Therefore, all learners should be perceived as a very "special" individuals who one day will take their place in society. It is the responsibility of educators to assist **all** learners (in spite of their shortcomings) to become productive members of society. This can be accomplished by helping each student establish attainable career goals and then providing meaningful experiences through which the student can achieve these goals. Every student should be treated with dignity, as an individual who has unique strengths and interests in life. It is not necessary or even realistic to expect every student to do and know all the same things. As stated by Jones (1977), "Learners should become worthwhile persons in their own right,...it is not necessary that they all become miniature images of the same pattern."

Purpose of Curriculum Modification

When working with students with special needs, a learner's curriculum may need to be modified or adjusted to take into account major differences which could be found among these individuals. The term "curriculum modification" can be defined as tailoring an existing curriculum to the unique needs of students as they pursue an occupational goal (Sarkees & Scott, 1985; Goh & Sitlington, 1983). However, it should be strongly emphasized that modifying a curriculum does not mean that an educator should lower or alter the standards of his or her program. What it does mean is that the Admission Review and Dismissal (ARD) Committee (for handicapped students) or coordinated planning team (for disadvantaged and LEP students) determines which essential elements in the regular school curriculum would be appropriate for a student's needs. The State Board Of Education Rules For Curriculum offers the following key points (Texas Education Agency, 1985):

1. For students with special needs, school districts shall provide modifications in methodologies, pacing, and materials to ensure that instruction is delivered, as appropriate, in the essential elements.

2. Students with special needs shall be instructed in those same essential elements in a manner appropriate to their needs.

3. School districts shall implement the provisions (under Chapter 75) in a manner which will enable all students to participate actively in a well-balanced curriculum and master, to the best of their abilities, the knowledge, skills, and competencies established through the essential elements.

4. Specialized personnel and regular program personnel shall be jointly responsible for the cooperative delivery of effective instruction in the essential elements, as appropriate.

It is important to re-emphasize that special needs students, as all students, have capabilities which widely vary. The challenge parents, educators, and vocational counselors face is to help each learner reach occupational goals which are within the student's potential.

The Curriculum Modification Process

In developing a meaningful and challenging vocational curriculum for a special needs learner, the ARD Committee or coordinated planning team should carefully review the student's vocational assessment information which consists of: (a) the student's capabilities, (b) parent and student interviews (including the career expectations of the learner), (c) the student's vocational interests and abilities, and (d) the teacher's informal behavioral assessments of the student.

After reviewing this information, the planning team can then work toward developing realistic and appropriate vocational goals for the student. Important items to consider when developing vocational goals include: (a) community employment needs, (b) vocational readiness skills, (c) multiple exit points (jobs that a learner can prepare for in the vocational program), and (d) entry-level competencies expected by employers for each of the exit points. In this way, the learner would be aware of realistic employment opportunities, specific skills needed for entry into a vocational program, and specific objectives which must be fulfilled in reaching an employment goal.

A number of special education curriculum models have been designed which take into account both the needs of a vocational program and the needs of the learner. The basic components which many of the designs have in common are as follows:

1. The importance of working with existing vocational curricula.

2. The importance of building upon the student's interests and competencies.

3. The identification of long range vocational goals and short range objectives--which are stated in measurable terms.

For the purpose of this overview, the competency-based curriculum modification model has been selected for discussion.

The Competency-Based Curriculum

Over the years, the concept of competency-based curriculum has increased in popularity largely due to the emphasis on accountability in education (Choate, et al., 1987). In addition, since the passage of P.L. 94-142, vocational educators have had to adjust their curricula to take into account the capabilities of special needs learners.

The underlaying principle behind the competency-based curriculum is to assist the student in becoming a more effective person. This entails helping the student develop skills or competencies which will promote employment opportunities and a higher self-esteem within the student (Brolin, 1976; Lippmann & Porter, 1976). The ability to succeed is what makes competency-based learning so valuable for students with special needs (Kok, 1978). With competency-based learning a student does not have to wait until the end of the program to experience success. The sequential steps called for throughout the program afford the possibility of success on a day-to-day basis (Lippmann & Porter, 1976).

The concept of competency-based learning is relatively simple. Based upon the learner's assessment information, the educator establishes specific goals (competencies) which will help the student "function adequately as a consumer, a producer, a learner, and a citizen" (Parnell, 1973). For example, in an auto mechanics class, the student's occupational program goals or competencies may include one or more of the following: (a) performing a simple lubrication, (b) repairing a tire, (c) changing the battery, (d) completing an engine tune-up, (e) completing a valve job, (f) fixing the carburetor, or (g) overhauling the engine. Next, the educator develops objectives and an individualized instructional plan for the student to follow. This individualized instructional plan includes: (a) an objective, (b) an introduction, (c) a learning activity, (d) a test/checklist, and (e) answers/feedbacks.

Therefore, in competency-based learning it is not necessary or even realistic for the instructor to expose every learner to all the aspects of a vocational program. Competency-based learning focuses on the quality of learning rather than the quantity of learning such that the student who has limited skills could still find employment (Kok, 1978).

Gills's Four-Step Model

An excellent competency-based paradigm or model which can be utilized by vocational educators to maximize a learner's vocational potential was developed by Douglas H. Gill (Sarkees & Scott, 1982). The design of Gill's model involves the use of four sequential steps and utilizes the regular vocational curriculum as a basis for the modification process.

Step one. The first step in Gill's model requires the educator to gain a clear picture of the existing curriculum any student would follow in a particular vocational program. Gill calls this step "Establishing the Curriculum Framework." The purpose of this step is to organize the existing curriculum in such a way that it can be modified. This step involves: (a) identifying the overall long range goals of the vocational program, (b) identifying and listing the short-term objectives that sequentially comprise each long-range goal, and (c) identifying the instructional units which comprise a sequence for attaining each short-term objective. An example of a curriculum framework which outlines an overall long range goal, short-term objective, and instructional units follows:

1. **Long range goal**: Given appropriate tools, equipment and materials, the student will be able to demonstrate instructor specified job entry level skills in the masonry area of construction trades at a comparable rate of time and accuracy to that found on the job.
2. **Short term objective**: The student will be able to demonstrate the basic skills of bricklaying.
3. **Instructional units**: Spreading mortar. Laying brick to a line. Building a brick corner. Cutting brick and block.

Once the long range goals, short term objectives, and instructional units have been outlined for a particular vocational program, the educator can begin the work of modification for a special needs learner.

Step two. Step two of Gill's four-step model, "Developing an Instructional Task Analysis," builds upon step one. The instructional task analysis lists the tasks that, when sequenced, make up the instructional unit. In this step the educator identifies the required tasks the student must perform, emphasizing what the student must do rather than what the student must read or write. An example of instructional tasks for one of the instructional units above follows:

1. **Instructional unit**: Spreading mortar.

2. **Instructional tasks**: Mix mortar.
   Identify and use trowel.
   Identify and use mortar board.
   Wet mortar board.
   Place mortar on board.
   Bunch mortar.
   Load trowel.
   Distribute mortar.
   Furrow mortar.
   Cut excess mortar.
   Seat mortar to trowel.
   Butter brick.
   Butter head joint.
   Lay one brick to another.
   Identify and explain purpose of running half-bond.

Therefore, establishing the curriculum framework and required instructional tasks (task analysis) organizes the instructional process and prepares for the next step in the process.

Step three. The third step in Gill's four-step model represents the implementation stage. This step, "Developing the Curriculum Supplement," involves developing usable supplements for the existing curriculum. The curriculum supplement is designed to be used jointly by the instructor and the resource support person. The curriculum supplement is composed of two major parts: (a) the Learning Plan and (b) the Supplemental Learning Plan.

The Learning Plan is used primarily by the instructor and consists of the following four basic parts:

1. Instructional unit

2. Instructional task

3. Performance-based task activities

4. Performance-based task check

The instructional unit and instructional task are components of the curriculum framework. The performance-based task activities describe for the instructor those task elements the student will do. The performance-based task check is a measurement of the student's ability to master the task at hand.

The Supplemental Learning Plan was developed for use primarily by special needs support personnel and consists of the following six basic parts:

1. Instructional unit

2. Instructional task
3. Task terminology
4. Essential math operations
5. Coordinated movements
6. Related concepts

The purpose of the Supplemental Learning Plan is to identify basic knowledge (task terminology, essential math operations, important concepts) and prerequisite skills (coordinated movements, related concepts) the learner must posses in order to complete an instructional task. The Supplemental Learning Plan can be very useful in helping the resource teacher and instructor identify those areas where instruction support may be needed. It is, therefore, very important that the Learning Plan and Supplemental Learning Plan be developed by the instructor, special education teacher, or support/resource teacher for each instructional task. In this way, if a learner has difficulty mastering a specific task, individualized activities can be developed by selected individuals to help the student resolve the problem.

Step four. The fourth and final step of Gill's model is the development of an individualized student module. The student's module is created from the Learning Plan and Supplemental Learning Plan and is the culmination of the curriculum modification process. The student's module consists of the following four components (Goh & Sitlington, 1983):

1. **Word section:** Includes terms identified on the supplemental learning plan, along with definitions of each term.
2. **Job tasks:** Definition of each step in the job. This appears in the student module under the heading "What You Do."
3. **Illustrations of job tasks:** The illustrations help clarify the job steps and should be clear and precise, without being complex.
4. **Evaluation procedures:** Both enroute (formative) checkups and a final (summative) performance check are included to assess the learner's progress through the module.

The student's module is tailored to help meet the specific needs of a learner and serves as a guide to assist the student in achieving instructional tasks. Various ways in which a student's module can be individualized to take into account the various learner differences found in the training setting are as follows (Goh & Sitlington, 1983):

1. The amount of detail and illustrations can be varied to take into account learner differences in intellectual abilities and educational backgrounds.
2. The mode of presentation can be altered to meet the needs of learners with differences in learning styles (e.g. audio-cassettes can be added for auditory learners).
3. The amount of feedback from the module and instructor can be increased or decreased to match differences in motivation, perseverance, and tolerance levels.

In summary, Gill's four-step model is a competency-based process flowing directly from the regular vocational curriculum. The steps range from establishing a curriculum framework to developing an individualized student module. Gill's model is not designed to replace or lower the standards of the regular vocational curriculum. It is a systematic process by which a special needs student can achieve solid vocational goals through the cooperative support of vocational instructors, special educators, and support personnel.

Responsibilities of the Vocational Educator

The primary responsibility of the vocational educator in the curriculum modification process is to help the special needs student establish and reach realistic occupational goals. In an effort to accomplish this, the vocational educator must identify the following (Sarkees & Scott, 1985):

1. Pertinent information about what will be taught in a vocational program.
2. Necessary requirements for program completion.
3. Multiple exit points (jobs that the learner can prepare for in a vocational program).
4. Entry level competencies expected by employers for each of the exit points.

It is also the responsibility of every vocational educator to establish an effective and wholesome learning environment for their students. Providing this environment may involve modifying the vocational facility, equipment, tools and/or instruction. This information will be provided in the following section.

MODIFICATION OF THE LEARNING ENVIRONMENT

The term "learning environment" refers to both the physical and instructional setting of the vocational classroom/laboratory (Bell, 1984). It is the responsibility of each vocational educator to work at developing a learning environment which will contribute to the overall well-being and success of every student. The key factors found in a wholesome learning environment are those which promote:

1. **Safety, organization, and physical comfort.** In the vocational laboratory, it is absolutely crucial that each student abide by safety rules set by the instructor. In addition, the laboratory should be kept well organized and clean. A laboratory which is safe, well organized, and physically comfortable helps promote high morale and good work habits.

2. **Respect and acceptance**. Within an effective learning environment, students will show respect not only for the instructor but for each other as well. The instructor should be the student's best role model. The care and acceptance given by the instructor to each student (disabled or non-disabled) will go a long way in promoting peer acceptance, a positive attitude, and healthy self-esteem.

3. **Discipline.** A wholesome learning environment is one which promotes discipline and a positive self-concept within each student. Inappropriate behavior has the potential to seriously affect classroom safety, morale, and the overall learning process. Ways in which the instructor can help the student modify inappropriate behavior include: (a) utilizing the time-out technique, (b) developing student-teacher contracts, (c) ignoring negative behavior--whenever possible, and (d) rewarding appropriate behavior with approval and praise.

4. **Flexibility**. An effective learning environment is flexible and can adapt to a special student's unique needs (i.e., slower rate of learning, inability to access regular tools/equipment, or remedial needs in reading or math for instance). A flexible environment fosters individualized programs through which a special learner can develop marketable skills for employment.

Modifying Facilities, Equipment, and Tools

In the past, many special needs learners have been denied their basic right to a public education because of architectural barriers, nonadaptive facilities, equipment, and tools (Phelps & Lutz, 1977). However, federal legislation has done a great deal to provide equal access to educational programs for every learner. For example, according to Section 503 of the Rehabilitation Act of 1973, each federally funded program or activity in which a handicapped individual can enroll and profit must be made accessible to the student (Sarkees & Scott, 1985). In addition, the Carl Perkins Act of 1984 has emphasized the importance of providing supplemental services for special needs learners, which include the adaptation of facilities, equipment, curriculum, and instruction (Cobb & Kingburgy, 1985).

Modifying facilities. A barrier-free facility planned for safety, efficiency, and convenience is of vital importance to individuals with special needs--especially those who are in wheelchairs, on crutches, or have artificial limbs. According to Sarkees & Scott (1985), three major areas in which architectural barriers may be present at most vocational education facilities are:

1. **Getting to and entering the building** -- getting to the ground from public or private transportation; parking; negotiating parking lot pavement, curbs, walkways, ramps, and stairways; and entering exterior doors.

2. **Moving about inside a building** -- moving through corridors and hallways; moving from floor to floor; identifying and entering classrooms, laboratories, and auxiliary areas; moving through aisles and traffic lanes inside classrooms and laboratories.

3. **Using school fixtures, appliances, and study/work station area equipment** -- using restrooms, drinking fountains, vending machines, tools, machines, and work station apparatus.

In an effort to eliminate these barriers, vocational educators, planners, and administrators should contact the State Architectural Barriers Board or State Department of Education regarding the guidelines and standards that have been developed for compliance with federal mandates. The federal government has adopted the American National Standards Institute (ANSI) accessibility standards as its mandatory guidelines for removal of architectural barriers (Sarkees & Scott, 1985).

Modifying equipment and tools. Based upon the needs of each special learner, it may become necessary to modify existing equipment and tools to accommodate the special needs student. The degree of modification will depend upon the type and extent of each student's impairment. It should be remembered, however, that equipment should be modified only to the extent necessary to assist the student. Whenever possible, as the student generates competence in a learning task, the modified equipment should be replaced with regular equipment (Phelps & Lutz, 1977). The following are some general suggestions in which equipment and tools can be modified for specific classifications of special needs students (Phelps & Lutz, 1977; Sarkees & Scott, 1985; Stern & Gathercoal, 1986):

Important Note: It is very possible that a number of these suggestions could apply to more than one category.

Furthermore, some of these modifications may be applicable to disadvantaged and LEP students. This, of course, would depend upon the needs of the particular student.

Modifications for Orthopedically-Impaired Students

1. Work benches can be cut out so that wheelchair bound students can pull up close to the work surface.
2. Modify the height of workbenches, storage cabinets, table tops, etc. to make them accessible to wheelchair bound students.
3. A lap board can be fitted on the arms of the wheel chair to provide a work area.
4. Rearrange storage areas for tools and supplies to make them accessible and as near to the work station as possible.
5. Position bench-mounted power tools on the ends of benches.
6. Semistationary equipment should be put on variable height bases.
7. Modify machine controls so that they can be operated with prostheses such as an arm hook.
8. Replace cabinet knobs with levers or handles.
9. Convert knob-type ON-OFF switches to toggle switches, levers, or slide-adjustment mechanisms.
10. Provide an aid that increases mechanical advantage in manipulating controls.
11. Convert machines and equipment that have hand controls to the foot pedal type for students who have upper extremity disabilities.
12. Select machines that do not require two-handed operation, such as a radial arm saw instead of a table saw.
13. Place small parts of instruments on a foam pad to aid students in picking them up.
14. Select tools that require only one hand to operate, such as split screwdrivers, which hold screws and bolts for starting.
15. Provide holding devices such as vacuum vises, stationary vises, clamps, jibs, and fixtures that permit one-handed operation.
16. Provide tools that supply more mechanical advantage to loosen or tighten screws or bolts, such as a lever-type socket set or an offset screwdriver.
17. For students who have weak hands, increase the size of tool handles by replacing them with larger diameter handles or by enlarging them with tubing or tape wrappings.

18. Provide templates to aid drafting students who have trouble manipulating standard drafting instruments.

Modifications for Hearing-Impaired Students

1. Install a red light next to the on-off switch so that the student can tell when the machine is in operation.

2. Install amplification devices on auditory warning signals so that they can be heard by those with partial hearing.

3. Use visual timers in place of those that emit sounds.

Modifications for Visually-Impaired Students

1. Purchase commercially available measuring tools with raised or engraved markings that can be read by touch.

2. Purchase measuring devices that provide auditory signals.

3. Brailled tape or raised marks can be used on control dials and switches.

4. Enlarge markings on tools, tool holders, or machine controls.

5. Provide jigs, guides, and templates to aid students in positioning and guiding tools.

6. Identify controls by changing their size, shape, or texture.

Modifications for Mentally-Impaired Students.

1. Color code important parts of machines or equipment.

2. Devise jigs, fixtures, templates, and guides to simplify work task operations.

Modifications for Limited English Proficient Students

1. Utilize name placards (Spanish and English) for machines, tools, and equipment.

2. Color code or use symbols for dangerous machines. For example, one red dot could indicate a dangerous machine and two red dots could indicate a very dangerous machine.

A wide variety of specially designed aids, tools, machines, and equipment are commercially available to assist the special needs learner. Occasionally, this material can be paid for through vocational rehabilitation centers or the school's special education program. Information pertaining to manufactured devices can be found in school supply catalogs or in catalogs published by special institutes. A very comprehensive resource has been developed by the Wisconsin Studies Center, University of Wisconsin-Madison, entitled Tools, Equipment and Machinery Adapted for the Vocational Education and Employment of Handicapped People. In addition, information is available through the school's special education personnel and vocational rehabilitation counselors (Sarkees & Scott, 1985).

In conclusion, two educational topics have been presented which are **fundamental components** to the successful instruction of learners with special needs: (a) developing or tailoring an appropriate curriculum and (b) establishing a favorable learning environment. Within the final section of this Overview, basic principles will be presented which will address the actual instruction of special learners.

MODIFICATION OF INSTRUCTION

The primary purpose of this section is to provide the vocational educator with teaching strategies and techniques that will be useful when instructing students with special needs. It is important to remember that the methods and approaches used by educators when instructing non-special needs students may not be very effective with students with special needs (Gleiss-Monar & Sitlington, 1983). Therefore, individualizing instruction becomes vitally important in the successful instruction of special learners.

Within this section, the following topics will be discussed: (a) learning styles, (b) teaching strategies, (c) remediation techniques, and (d) Brown's 3-Cs Instructional Mode.

Learning Styles

Each special learner has unique needs and these needs affect how the student can best learn. For example, if a student is blind or has difficulty with "visual" learning, the instructor should stress the learner's sense of sight. Therefore, the manner in which a student with special needs learns ceases to be a preference, but becomes instead a necessity (Kok, Jernigan, & Hull, 1978). Further, one of the main philosophies behind individual learning styles is that learning should be a pleasant and successful experience. Educators, therefore, should adjust their style of teaching to allow students the benefit of learning in their preferred manner (Kok, Jernigan, & Hull, 1978).

Identifying a student's learning style.

The following are methods in which an educator can identify a student's learning style:

1. **Informal observation.** One of the simplest and possibly best ways to identify a student's learning style is through informal observation. By observing the student as he or she negotiates classroom/laboratory learning activities, the educator can collect valuable information with regard to the student's learning style. For example, the educator may observe that a disadvantaged student answers questions in class and does well with hands-on activities but repeatedly fails written exams. If the primary intent of the instruction is to reach vocational skills rather than reading and writing skills, the instructor could modify their style of teaching by allowing the student to take oral and/or hands-on exams (Kok, Jernigan, & Hull, 1978: Sarkees & Scott, 1985).

2. **Teacher consultation.** Consulting other teachers (i.e., special education teachers, resource room teachers, support personnel, paraprofessionals, and other vocational education teachers) can be an excellent source for information regarding a student's learning style (Sarkees & Scott, 1985).

3. **Student/parent interviews.** Interviewing the student and student's parents/guardians can result in valuable insights as to the student's best learning modes (Sarkees & Scott, 1985)

4. **Standardized inventories.** Standardized inventories provide an alternative for students who are shy or uncomfortable during a personal interview. Information received from interest, personality, and learning style inventories can provide valuable information with regard to the student's learning style (Kok, Jernigan, & Hull, 1978; Sarkees & Scott, 1985).

Teaching Strategies

Once the student's vocational goals, learning capability, and preferred learning style have been identified, the educator can begin to experiment with a variety of teaching techniques and instructional materials. When determining the teaching technique and instructional material best suited to meet a student's unique needs, it is important for the educator to be patient, open-minded, and flexible. Not every instructional technique and/or material can be used successfully with each learner (Sarkees & Scott, 1985). In addition, the educator should not hesitate to enlist the support of other instructors, school counselors, student aides, paraprofessionals, volunteers from the community, itinerant teachers, and/or interpreters. This pooling of efforts can result in increased student learning because of the variety of approaches and personal attention which can be brought to the classroom or laboratory (Harrington & Fardig, 1982).

The following are general guidelines and instructional techniques which an educator can use to help meet a special needs learner's unique needs and learning style:

1. **Orientation**. Students with special needs may need additional orientation with regard to: (a) the relevancy of their individualized goals, (b) class procedures, (c) safety, etc.

2. **Flexible pacing**. Students with special needs can exhibit different rates of learning. The educator should provide flexibility in pacing of instruction and assignments to meet the various needs of learners. In general, students with special needs should be individually paced to maintain their progress and interest, yet avoid the frustrations and failure undue pressure may cause (Harrington & Fardig, 1982; Sarkees & Scott, 1985).

3. **Demonstration.** Utilization of the demonstration method can be very effective in introducing a new skill to a learner with special needs.

4. **Breaking material into small distinct steps**. As a general rule, it is important for the educator to break a learning concept into small distinct steps. In this way, the educator can best identify where the student is experiencing difficulty.

5. **Positive environment and feedback**. In general, students with special needs lack confidence and a positive self-concept. This is primarily due to their not having had much success in life. In addition, the few successes special learners do have usually result in little, if any, positive reinforcement (i.e., praise, reward, and/or encouragement). Therefore, it is incumbent upon educators to create a positive, nonthreatening learning-environment for their students and to make generous use of positive feedback when the student experiences success. Constructive criticism should not be avoided; however, it should be given in a positive manner (i.e, students should understand that their behavior or product is what's being criticized and not their worth as a human being). Finally, all students must learn that mistakes and constructive criticism are a normal and expected part of life (Harrington & Fardig, 1982).

6. **Use of peer tutors, college students, and volunteers**. Use of peer tutors, college students, and volunteers can greatly assist a vocational educator's work with special learners by: (a) helping with individualized instruction, (b) providing positive role models, (c) increasing student participation, (d) increasing the special learner's success experiences, (e) increasing the student's confidence and self-esteem, and (f) improving the special learner's social and academic skills (Asselin & Anderson, 1986). In addition, peer tutors, college students, and volunteers can receive teaching experience and the satisfaction of helping individuals with special needs progress.

7. **Flexible grouping**. The educator can integrate special needs learners into groups of various sizes (according to the student's goals, interests, or ability level) and utilize peer tutors, college students, and volunteers for assistance. According to Sarkees & Scott, grouping students has the following advantages: (a) it allows the teacher more time to work among the students, (b) it allows the teacher to individualize instruction, tasks, and assignments to meet the needs of students in a specific group, (c) it provides special needs learners with an opportunity to work with peers and establish positive interpersonal and working relationships with them, (d) it serves as a motivating factor for special needs learners because the individualized nature of the group work does not become threatening or frustrating but allows students an opportunity to work at their own pace through their strongest learning style, (e) it allows teachers to arrange for instruction for the entire class, small group discussions, project groups, and small remedial sessions so that instruction will be diversified and more meaningful for all students; and (f) it allows the teacher to modify the task or assignment for a small group of students with specific needs, as in the case of learners who have a physical disability (Sarkees & Scott, 1985).

8. Providing field trips and job site visits. Scheduled field trips and job site visits can give all learners a realistic first-hand look into the real world of work. By "shadowing" workers in a particular occupational area, students can gain helpful insights into their own career decision. In addition, a field trip or job site visit can be very motivational in that the student can readily observe how his/her vocational training will be used in the world of work (Sarkees & Scott, 1985).

9. **Use of media**. Utilizing media can embellish instruction by: (a) assisting the teacher in presenting the proficiency or skill requirements for a specific job, (b) reinforcing concepts presented in a classroom, laboratory, or demonstration activity, (c) providing a vehicle for special needs learners to show what they have learned, (d) providing a valuable source of remedial assistance, (e) providing simulated learning experiences, (f) allowing special needs students to learn through their strongest style, and (g) adding variety to the instructional program. Examples of media include: computer assisted instruction (CAI), 16 mm films, film strips, flip charts, overhead transparencies, tape recorders, records, posters, magazines, and diagrams (Sarkees & Scott, 1985).

10. **Use of student-teacher contracts**. Student-teacher contracts can be excellent tools in helping learners with special needs achieve their vocational goals. The following guidelines should be used in developing and implementing a student-teacher contract: (a) decide on the task or project, (b) specifically state the requirements, (c) determine the minimum acceptable accuracy, (d) set a time limit--initially, short assignments and short time periods are usually best, (e) identify consequences, (f) discuss contract with student and support personnel, (g) have all parties sign the contract, (h) positive reinforcement should be given if the terms of the contract are satisfactorily met, (i) uncompleted contracts should be analyzed by the teacher and student to determine the causes, and (j) develop new contracts cooperatively (Sarkees & Scott, 1985).

The following is a list of specific teaching strategies which educators can utilize when addressing the unique needs of handicapped students (Sarkees & Scott, 1985; Stern & Gathercoal, 1986; Tindall; 1980):

Important Note: It is very important to note that many of these teaching strategies could be used for all students. Appearing later in this Overview is a listing of instruction strategies which could be generic to all special needs students.

Instructing Students Who Are Mentally-Impaired

Involve as many different senses as possible in the learning process.

Use concrete specific terms rather than abstract terms. If necessary, have the student repeat the necessary information to you.

When giving written directions use lists instead of paragraphs. With regard to the student who can barely read, contact the remedial reading staff and arrange reading instruction. This instruction should focus on required reading for your course and that which is vital for employment.

Teach by demonstration (whenever possible). Don't hesitate to use hand-over-hand assistance in demonstrating how to use a tool or machine.

Allow time to practice machine or tool processes.

Break down complex operations into smaller tasks.

With regard to feedback, let the learner know what is wanted, and whether or not the student is achieving it. Give lots of positive reinforcement and encouragement. Nonverbal feedback is also helpful (i.e. touching the student or task, pointing, blocking or stopping an error as it is developing, and guiding the learner's movements). In addition, provide specific feedback with regard to the student's work. For example, the educator should say, "This piece was cut exactly to the right size," or "You put these two parts together correctly, " or use Mark Gold's expression "Try another way" (Gold, 1975).

Build the student's confidence by: (a) utilizing activities that will assure success, (b) assigning special tasks which will communicate with the educator's confidence in the student, (c) giving students an opportunity to correct their work and hand in a good project or assignment, and (d) displaying the student's good work.

In helping students with their ability to make correct discriminations, utilize Gold's "match to sample" technique in which the student is provided an example and a number of choices. The student will choose the correct alternative based upon the characteristics of the sample (Gold & Scott, 1971).

With regard to helping the student make correct discriminations when there are minimal differences between the stimuli, it may be necessary to: (a) present the choices in an easy form at first, (b) exaggerate attributes, (c) make the choices gradually harder, or (d) add and fade out color cue, add and then gradually remove large cue differences, or combine these two approaches.

Retention/memory can be improved by: (a) being systematic and presenting one new piece of learning at a time, (b) relating new material to familiar material, and keeping it practical and concrete, and (c) utilizing training techniques such as the total task method, chaining, modeling/demonstrating, and the structured overview (see Tindalls' Puzzled About Educating Special Needs Students).

"Generalizing", or having the student apply what has been learned to the contexts, can be improved by: (a) using examples from different relevant contexts and (b) practicing in settings similar to or exactly like those that will be encountered on the job.

Instructing Students Who Are Hearing-Impaired

In private, discuss with the student his/her ability to communicate with you (lip/speech reading, use of hearing aid, writing, signing, and total communication). An open discussion with the student which demonstrates your concern as an educator is an excellent beginning in building rapport.

Body language communicates messages too. Remember not to give mixed messages with your body language. Also, be alert to the body message the student is giving you (i.e., is he/she communicating tension, nervousness, avoidance, or confusion?)

If you will be working with an interpreter, do not instruct the deaf student as if he/she were a third party. Speak directly to the student. Also, remember that the interpreter is ethically bound to interpret everything you say. Therefore, sensitive or other issues concerning the student is best addressed in a meeting before or after class. If you are using media where the room must be darkened, focus a small lamp on the interpreter.

Maintain good eye contact with the student while speaking.

Speak slowly and clearly, pronouncing each word, but without exaggerating or over pronouncing.

Do not stand in front of a window while speaking. The light should be shining on your face and not the student's.

Try to rephrase a thought rather than saying the same words over again.

Encourage the student to read ahead on class material.

Try to keep the noise level down as much as possible in the class/laboratory.

Utilize handouts, the chalkboard, and other media.

Install a light to indicate when dangerous machinery is on.

Instructing Students Who Are Speech-Impaired

Always maintain eye contact and nod your head while the student is talking. This will help the student build confidence.

Work cooperatively with speech therapist and/or communication specialist to determine which technique will help most in assisting these students to communicate more effectively.

Encourage peer tutoring and small group activities to help the speech-impaired student develop interpersonal relationships with the other students.

Always allow sufficient time for the student to complete his/her sentence.

Try not to act uncomfortable when these individuals are communicating with you (i.e., discontinuing eye contact, shifting your position, clearing your throat). Your discomfort can be very discouraging to the student.

Do not require these individuals to present oral reports until they feel comfortable in the classroom environment.

Model correct sentence structure for the speech-impaired student so he/she can follow your example.

Develop a list of technical terms used in your class and share these terms with the speech specialist to help the student become more confident n pronouncing terms used in class.

Instructing Students Who are Visually-Impaired

Orient the student to the classroom or laboratory before the course begins. Consistency and orderliness in the physical environment is very important to the visually-impaired student.

Arrange seating so the blind student will be able to hear the instruction and to allow for the best distance and lighting conditions for the partially sighted student.

Provide as many opportunities as possible for the visually impaired student to observe closely or to touch the materials.

Give materials and handouts to the student ahead of time. Also, a student peer can assist the visually-impaired student by making a carbon copy or a photocopy of their notes. Also, when possible, the educator can make a copy of their teaching notes. In this way, the visually-impaired student can review the materials with a tutor or have them transcribed into braille or taped.

It is important to gain and maintain the student's attention. Approval or disapproval will need to be verbalized.

Remember there is no need to talk louder to a visually-impaired student.

Rehabilitation counselors or special needs teachers can be useful resources in helping the student use commercial or modified learning aids or tools.

Tests may need to be prepared in large print, braille, on cassette tapes, or converted into exercises using the sense of touch. Also, it may be necessary to allow the student extra time to complete the test.

The tape recorder is the most frequently used technique for notetaking and preparing modified learning materials for the visually-impaired student.

The following is a sample of specially designed machines now available for the visually-impaired student: (a) OPTACON (Optical to Tacile Converter) allows students to read printed material, (b) STEREOTONER is similar to the OPTACON but converts the printed word into a tone pattern, (c) OPTOPHONE and VISOTACTOR convert print into sound, and (d) KURZWEL READING MACHINE which converts standard English text on a computer into easily comprehended speech.

A number of general tools or aids which can assist the student in reading or writing lessons for vocational courses follow: (a) braille, (b) large print, (c) tape recorders, (d) talking books, (e) raised letters, (f) slate and stylus (used to make notes), (g) braille writer (a 6-key manually operated machine), (h) typewriters, (i) braille verifier (types braille and regular copy simultaneously), and (j) signature guides.

Aids for mathematics and computer programming courses follow: (a) abacus design for the blind, (b) raised clock faces, (c) wire geometrical forms, (d) braille rulers, (e) raised-line checkbooks, (f) raised-line boards, (g) braille dominoes, (h) braille flash cards, (i) cubes with raised braille dots used for simple mathematical problems, (j) raised-line paper or graphs, (k) computer terminals that use braille printers, or those that type braille and conventional type simultaneously, and (l) talking calculators.

Aids used frequently in other vocational courses include: (a) braille maps, charts, diagrams, (b) self-threading needles, (c) wooden or cardboard models of specimens that other students see through microscopes, (d) braille micrometers and other shop tools that have special raised markings, (e) braille demo tapes to mark lab equipment and models, (f) light probes with audible sounds that check the operating status of machines, and (g) guides or templates to help students align objects properly.

Instructing Students Who Are Seriously Emotionally Disturbed

Consult with the student's parents, special education teacher, or counselor to determine whether any particular teaching techniques will help or hinder learning.

Try to understand the student. Disturbing behaviors are the outward sign of inner turmoil.

Go easy on bad days and avoid direct confrontations that would aggravate the situation.

Communicate acceptance to the student and a willingness to help him or her succeed in class.

Provide immediate feedback and reinforcement.

Establishing a rapport and trust with the student is important.

In the beginning of the semester, help the student gain confidence by giving him or her lessons in which success can be achieved in a series of small steps.

A measure of privacy when the student attempts a new task can ease his or her embarrassment at any awkwardness or ineptness.

Allow the student to correct mistakes prior to turning in an assignment or project to ease any pressure.

Help the student not to overreact to failure and praise him or her for continuing to try.

Cue appropriate behavior in a quiet, unemotional manner.

In resolving discipline problems: (a) do so in privacy, (b) focus on objective facts in a calm, supportive tone, (c) actively listen to the student, (d) after listening to the student, reflect on what has been said, by telling the student what you've heard, (e) ask the student if he or she has any ideas about solving the problem (encourage the student to be specific), and (f) conclude with a clear understanding of the changes, timeframe, and benefits which are expected.

In handling aggressive behavior: (a) try to remain calm and model the controlled behavior which you desire, (b) intervene by either separating the individuals involved and having them work on another activity or having them take a time-out in separate corners of the room, (c) if necessary, send an uninvolved student to the office to get help, either in talking to the students or in managing the class while the teacher talks to them, and (d) return to normal classroom procedure as quickly as possible.

Access professional collegues in special education evaluation, counselling, or therapy when the student's behavior appears to be in need of additional attention.

Instructing Students Who Are Orthopedically-Impaired

In general, students with physical handicaps will be intellectually capable and able to participate in vocational programs.

Make the necessary modifications in classrooms, laboratories, equipment, building accessibility, and lavatories.

For notetaking the student can: (a) use a tape recorder, (b) have a classmate slip a carbon copy into his/her notebook to duplicate notes, and/or (c) have the instructor prepare an outline of the lecture.

For exams the instructor can: (a) give oral exams, (b) have the student dictate answers into a tape recorder or to another student, or (c) utilize a typewriter/computer if the student is able to type/keyboard.

Give the student more time to complete homework assignments. Also, giving the student advance notification of assignments is helpful.

In the laboratory, pair the student with one or more capable students in the class.

Enlarge copies of frequently used charts and diagrams posted near the student's desk eliminates the necessity of paging through a book.

Instructing Students Who Are Other Health-Impaired

Allow the students sufficient time for rest.

Seat the student in the most convenient place for easy access to necessary facilities (hall, lavatory, chalkboard, laboratory work stations).

Allow the students to work on program requirements at his or her own pace.

Tape lectures so the student can listen to them at home.

Work cooperatively with the health team in order to learn more about the student's special needs.

Utilize community resources personnel (social workers and itinerant teachers for home-bound students) for delivery of materials, assignments, and handouts.

Instructing Students Who Have Specific Learning Disabilities

Use visuals and demonstrations as often as possible.

Use concrete examples whenever possible.

Provide student with an outline of what will be covered in class.

Make sure all printed materials are clear and readable.

If the student has a visual perception problem, allow him or her to tape-record assignments.

Allow students to take tests orally or in a mode that compliments their performance.

Present new information in small amounts.

Make sure that writing assignments are relevant to the content of the program.

Allow students a longer period of time to complete assignments, if necessary.

List assignments in steps.

Task analysis can be used to lower the frustration level of these learners.

Programmed instruction materials can be very effective with these learners.

The following is a list of specific teaching strategies which can be very useful when working with students who have **limited English proficiency** (Sarkees & Scott, 1985):

Recognize the student's cultural background and allow for the student's individual differences.

Encourage these students to bring dictionaries to class.

Use demonstrations and hands-on experience as much as possible.

Speak slowly and use simple vocabulary and grammar.

Use bright felt tip markers to mark important words, passages, or illustrations.

If possible, use a translator for important concepts.

Work closely with LEP support personnel.

Keep homework assignments short.

Check for comprehension by asking the student what you have said.

Use simple sentences when writing test items so the student can concentrate on answering the question rather than deciphering it.

And finally, with regard to the disadvantaged population, typically these individuals dislike school, lack motivation, and have a low self-concept or esteem. Therefore, an educator's personal commitment and high expectations for the student may be two of the biggest single factors which will make a positive difference in this individual's life. Additionally, an educator's good example (i.e., being patient, understanding, well organized, and a good manager) can be extremely valuable in motivating and positively shaping the student's behavior (Baca, 1981). Vocational education can offer a great deal to the disadvantaged student in terms of teaching academic and social skills relative to the student's potential employment (Baca, 1981). The following are additional techniques or teaching strategies which can be very useful when working with disadvantaged students (Baca, 1981):

The educator should seek to understand the student's educational and social background through: (a) assessment information, (b) interaction with former teachers, (c) discussions with counselors, and (d) visits with parents to ascertain the student's social limitations and home situation.

Basic math, communication, and social skills should be reinforced. Math skills can be reinforced through hands-on learning activities. Communication skills can be improved by tactfully correcting poor grammar, when appropriate, and by providing resources that encourage reading in job related interests.

Social skills such as getting along with people, grooming, proper dress, and respect for property and authority should be reinforced on a continual basis.

The importance of finishing school should be continually stressed. Relate acquisition of job skills to earn income.

Reinforce the student's feelings of self-worth by having high expectations for the student and by providing immediate reinforcement for work done well.

Simulate realistic job situations. All classroom and laboratory experiences should relate to employment in the occupation being studied.

Disadvantaged students (as all students) will typically react to the learning environment in a responsible and mature manner when they are treated with respect and as adults by the educator.

Classroom organization and discipline (being firm but not overbearing) are especially important. Generally, disadvantaged students want and need structure and discipline within their lives. Usually, these individuals will be responsive to and respect teachers who are firm, but sensitive.

Help the student develop employability and job coping skills (i.e., skills associated with finding, applying for, and retaining a job).

Help the student establish good work habits by keeping him or her involved with meaningful learning experiences. Each activity should have concrete learning objectives.

Disadvantaged students may need more encouragement to stay on task; however, they still should be required to complete all assignments (just as they will be required to do on the job).

Present instructions and information in clear, logical steps--building from the simple to the complex.

Technical terms should be communicated clearly and concisely and written in language which the students will understand.

Incorporate a variety of instructional methods in the curriculum (i.e., demonstrations, resource personnel, field trips, peer tutors, role playing, audio-visual aids, and on-site work experiences).

Present supplemental materials when appropriate. If such material is relevant to the acquisition of job skills, the student will not be humiliated by simplified material.

Highlight important parts of the student's text with a light marker to prevent the student from feeling overwhelmed with a larger volume of reading material.

Progress charts can be utilized to motivate disadvantaged students to master new skills.

Utilize flash cards (teacher made or commercial) to reinforce new terms and the use of tools and equipment.

When teaching special needs students, it is very important that instructors do not limit their instructional techniques. Therefore, the following abstract of instructional techniques or strategies has been prepared which could be considered generic to all special needs populations.

- Involve as many different senses as possible

- Use concrete terms
- Have students repeat important information
- Use lists rather than paragraphs for written directions
- Teach by demonstration
- Use hand-over-hand assistance when necessary
- Allow practice time
- Break complex operations into smaller tasks
- Provide immediate feedback
- Build confidence

- Help student make correct discriminations
- Help student with their retention/memory
- Help student generalize knowledge
- Build rapport
- Use appropriate body language
- Use appropriate techniques when working with an interpreter

- Maintain good eye contact
- Speak slowly and clearly
- Rephrase thoughts when necessary
- Encourage the student to read ahead
- Keep the noise level down
- Utilize various forms of media
- Use lights to indicate when dangerous machinery is on
- Work cooperatively with therapists
- Encourage peer tutoring
- Try not to act uncomfortable around special needs students
- Help students feel comfortable
- Model correct sentence structure
- Develop a list of technical terms for students and/or therapists

- Orient students before the course begins
- Provide handouts ahead of time
- Maintain student's attention
- Use tape recorders for note taking
- Try to understand the student
- Communicate acceptance
- Develop success experiences for the student

- Use appropriate behavioral management techniques
- Facilitate the students with their notetaking

- Facilitate the students with exams

- Pair students
- Enlarge charts and diagrams
- Use clear readable visuals frequently
- Provide an outline of material which is being taught

- Writing assignments should be relevant
- Use task analysis when necessary
- Allow for individual differences
- Encourage students to bring a dictionary
- Use felt tip marker to highlight important parts
- Do not make homework assignments too lengthy
- Use simple sentences when writing test items

- Reinforce basic education and work skills
- Reinforce the importance of finishing school
- Reinforce the student's feelings of self-worth

- Simulate realistic job situations
- Treat all students with respect and dignity
- Provide structure and organization
- Utilize progress charts
- Utilize flash cards

Remediation in the Basic Education Skills

It is very important to note that some students may need to acquire one or more basic education skills (i.e., mathematics, reading, writing, speaking, listening, interpersonal relations, and/or reasoning skills) to succeed in a vocational program. In addition, many employers will not hire an individual if he or she lacks these skills. Therefore, instruction in basic education skills may be necessary by the vocational educator. For information concerning basic or generalized skills instruction see Module 8.

Brown's 3-C Model

Brown's 3-C Model helps tie together many of the educational aspects discussed in this Overview. In general, Brown suggests that when delivering instruction to learners with special needs, the instructor can enhance the student's success rate and reduce feelings of frustration by considering the following 3-Cs of instruction: (a) correction, (b) compensation, and (c) circumvention (Brown & Dayser, 1982):

Correction. Providing feedback when the student's skills are being developed, thereby, correcting inappropriate behaviors immediately after they appear. Employing remedial reading and math services to enhance the student's ability to function within the program.

Compensation. Helping the student realize that each task represents only one of many activities contained in the course and that weaknesses in one area can often be offset by strengths in other areas. It should be communicated to the student that some tasks are inherently difficult and that he/she should not expect to achieve success immediately. Further efforts to compensate for the student would be to modify or adjust the delivery of instruction to extend over segments of several class periods. In addition, reinforcement during the early stages of instruction should be amply provided.

Note: Basically, "compensation" involves the instructor's modifications to the curriculum, learning environment, and instruction which has been discussed in this Overview.

Circumvention. If the vocational program is way out of reach for a student, for example, due to a course requirement of a relatively high level of reading skill, it may become necessary for the student to "circumvent" this difficulty by discussing alternate training programs with a vocational counselor.

Summary

Modification of curriculum, learning environment, and instruction can be an important key to successful employment training for special needs students. It requires that the instructor know his/her content completely, but the benefits to all students will likely be extraordinary.

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APPENDIX B

REFERENCES/RESOURCES

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APPENDIX C

ANSWERS TO ASSIGNMENT SHEETS

ANSWERS TO ASSIGNMENT SHEETS

ELECTRICAL TRADES I

SAFETY

SAFETY: Electrical Safety Terms and Definitions

	ACROSS		DOWN
1.	Ground	2.	Dead
4.	Approved	3.	Qualified
6.	Safety	5.	Overload
8.	Modification	7.	Accident
11.	Live	9.	Defective
12.	Electrical	10.	Circuit

SAFETY: Electricity

1. It reduces its resistance
2. It acts as the return line to the battery ground
3. If it is dry, the skin is a fair insulator
4. Large wire allows more, small wires allow less
5. Water will flow in one hose. Electricity must also have a return line
6. People differ in their resistance to electricity
7. They probably do not fear and respect it enough because they do not know it can be deadly
8. It becomes a part of the circuit
9. Water reduces resistance and the chance of electrocution is much greater
10. A regular schedule of inspection and maintenance

SAFETY: First Aid

1. Protects the person who helps an accident victim
2. Germs can enter and infect the wound
3. Tetanus germs are not washed away and can cause lockjaw
4. Direct pressure

5. The supplying blood vessel to the leg wound can be squeezed but not the chest wound
6. It is dangerous. It can cause shock and/or gangrene
7. Compound fracture. Infection is almost certain
8. Brain tissue dies due to lack of oxygen from blood
9. They increase the chance of infection
10. You can be electrocuted yourself it they are still part of the circuit

SAFETY: Causes of Industrial Accidents

1. Fatalist
2. a. Unsafe conditions; b. Unsafe actions
3. Unsafe actions
4. Horseplay
5. One with a bad safety attitude

SAFETY: Safety Attitudes

1. Bad safety attitudes
2. They affect our behavior
3. We learn them through experiences
4. Their own lives and their co-workers' lives
5. Indifferent
6. Toward the end of the month when bills are due
7. By watching their work habits
8. Rubber or plastic gloves
9. Past accidents
10. Accident prevention

SAFETY: Safe Work Clothing

1. Hazards of the job
2. Comfortable to wear, fire resistant, and durable

3. They are dangerous and should not be worn
4. Close fitting with short sleeves
5. Tripping and clothing fires
6. Protection for the feet and slip resistance
7. When working with power tools or near machines with moving parts
8. Chemicals can damage the skin or go directly into the bloodstream
9. In the pockets
10. Dress properly

SAFETY: Eye and Ear Safety

1. Movie camera
2. Sight and hearing
3. Safety glasses, goggles, and face shields
4. Intensity or loudness, frequency or pitch, duration or time
5. Causing pain, nausea and vomiting, reduced muscle control
6. Hair cells
7. High frequency
8. 85 to 90 decibels
9. Tingling or ringing in the ear
10. Earplugs and ear muffs

SAFETY: Respiration Hazards

1. Lungs and skin
2. Take in oxygen and remove carbon dioxide
3. Carbon monoxide gas
4. About eight minutes
5. Lung cancer
6. Particles in the air
7. It can only absorb a certain amount

8. Lower groin or scrotum
9. The toxic chemical and oil based materials are both deadly
10. Being aware of the danger and proper handling

SAFETY: Accident Prevention

1. 25% or one in four
2. The workers themselves
3. Ten pounds or less
4. Lower back
5. Disks
6. Muscle attachment and protection of spinal cord
7. Very few
8. Rupture
9. Death
10. Your back

SAFETY: Safe Use and Care of Hand Tools

1. Lever, wheel and axle, inclined plane, wedge, screw
2. Knowing the tools, why and how they work, and knowing how to take care of them
3. The wheel and axle
4. Good tools reduce the dangers involved
5. Horseplay in the shop can be very dangerous
6. Toward the movable jaw
7. With an open hand
8. This heats up the saw blade and ruins it
9. Toward the end opposite the tang
10. The condition of their tools

SAFETY: Power Tools and the Industrial Color Code

1. Two cords to carry current and one to ground the tool
2. It can be dangerous and can damage the tool
3. It can cause over-confidence by looking easy
4. Only when absolutely necessary
5. A competent, safety minded worker and machine safety features
6. It should be held in a clamp or vise
7. With the power disconnected and the line rolled up
8. When "blue" one is distressed, green with envy, a coward is yellow, etc.
9. Safety colors communicate messages simply by their presence
10.

SAFETY: Fire Prevention and Control

1. Fuel, oxygen and heat
2. Both are valuable servants but dangerous
3. Preventing one from starting
4. The source of heat
5. By the type fire they are designed for
6. Electricity can travel down the stream of water and electrocute the person
7. By what is burning
8. To put out clothing fires
9. Everyone
10. Type D, combustible metals

ANSWERS TO ASSIGNMENT SHEETS

ELECTRICAL TRADES I

INTRODUCTION TO ELECTRICAL TRADES

INTRODUCTION TO ELECTRICAL TRADES: Terms and Definitions

1. Alternating current (AC)--electrical current flowing one way at steady space in time
2. Ampere (AMP)--a unit for measuring the strength of an electric current
3. Circuit--the complete path of an electric current, such as from the power source through a lamp and back to the power source
4. Circuit breaker--a safety device which breaks the circuit by tripping a switch instead of burning out the wiring or appliance
5. Conductors--materials through which electrical current flows
6. Current--the flow of electricity in a wire or other conductor
7. Direct current (DC)--electrical current flowing one way at a constant rate
8. Electricity--a kind of energy or power which can be changed into useful form
9. Electric meter--a device which measures the amount of electricity used
10. Fuse--a safety device which burns out when too much current flows through the circuit
11. Ground--a connection to the earth which serves as a return circuit
12. Horsepower (HP)--a unit of mechanical power which is the same as 746 watts of electrical power
13. Hot wires--the wire that carries th electrical current
14. Insulation--a cover over wires to keep electricity from escaping
15. Kilowatt (KW)--1000 watts
16. Kilowatt hour (KH)--1000 watts used for one hour
17. Neutral wire--a wire that does not carry electrical current
18. Resistance (OHM)--electrical friction
19. Short circuit--a side circuit caused by faulty wiring so that the electric current is turned aside from the main circuit
20. Switch--a device used to open or close a circuit
21. Volt (V)--a unit for measuring the force of an electric current

22. Watt (W)--a unit for measuring electric power

23. Watt hour--one watt used for one hour

INTRODUCTION TO ELECTRICAL TRADES: Occupational Outlook

1.	F	6.	T
2.	T	7.	F
3.	T	8.	F
4.	T	9.	T
5.	F	10.	T

INTRODUCTION TO ELECTRICAL TRADES: Related Careers

Evaluated to the satisfaction of the instructor.

ANSWERS TO ASSIGNMENT SHEETS

ELECTRICAL TRADES I

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES: Learning About Pliers

1. Quality tools will last much longer and will consistently provide good results.

2. Curved handles on pliers are for greater control over the tool, such as cutting, bending, looping, and forming wire.

   Handform handles are shaped to fit the hand; this gives the plier user a fuller grip and allows for more cutting power.

   Extended handles provide for a longer reach of the plier and provide increased leverage.

3. Curved handles
   Handform handles
   Extended handles

4. Curved handle

5. Handform handles

6. For comfort

7. overall length
   jaw length
   jaw width
   jaw thickness
   knife length
   point thickness

8. Full-flush cutting knives

9. Repair of pliers is not recommended

10. Cutting knives are sharpened with a small medium-grade hone, knurls inside plier nose are cleaned with a wire brush, and the plier hinge is oiled on occasion with a drop of oil.

11. It may cause damage to the pliers, the work, the user, as well as cause loss of time.

12. If too light a plier is used or if cheaters are used to give extra length to plier handles.

13. Heat and direct flame will ruin a plier by drawing the metal temper.

14. The knives may be dull, or perhaps a plier of greater leverage is needed.

15. All-purpose tools will shear bolts, cut wire, strip wire, measure stud sizes, gauge wire size, crimp lugs, and crimp splices.

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES: Learning About Screwdrivers

1. phillips
2. pressures put on them
3. offset screwdriver
4. stubby screwdriver
5. twist and distort
6. concave
7. pressure
8. maintain proper alignment
9. screw slot
10. climb out
11. only
12. downward
13. phillips
14. splitting
15. vends the shank

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES: Learning About Saws

1. F
2. T
3. T
4. T
5. T
6. T
7. T
8. F
9. T
10. F
11. F
12. T
13. T
14. F
15. T
16. T

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES: Learning About Drilling Tools and Equipment

1. conduit
2. chuck
3. pistol grip
4. center
5. grounded
6. square
7. swing
8. pulls
9. course screw
10. spurs
11. 1"
12. 60
13. wood
14. metal
15. hard

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES: Learning About Hammers

1. T
2. F
3. F
4. T
5. T
6. F
7. F
8. T
9. T
10. T

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES: Learning About Soldering Equipment and Supplies

1. solid core
2. rosin core
6. solder
7. wedge

3. melting

4. speeds up

5. uniform

8. pairs

9. heating unit

10. gasoline blow

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES: Learning About Measuring Tools

1. B

2. E

3. G

4. A

5. F

6. D

7. C

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES: Learning About Fishing Tools and Materials

1. Fish tape is used to pull wires through conduit and through wall or ceiling openings.

2. One with a thickness of .060" and width of 1/8".

3. flex fish tape

4. puller handle

5. spiral-wound and multi-layer

6. It is equipped with large eye loops in each end.

7. They may be used as leaders for flat tapes.

8. Wire pulling lubricant is used.

9. Talc, soapstone, flax, soap, or a combination of these

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES: Learning About Conduit and Pipe Tools

1. By holding conduit in a fixed position and moving the hickey or by holding the hickey in a fixed position and shaping the conduit to the hickey.

2. Offset, saddle, right-angle, etc.

3. It is more difficult to start than a wheel and roller cutter to make sure the cut is straight and it leaves more of an outside burr.

4. It is able to cut a pipe in a close place.

5. It cuts pipe quicker and more accurately than a hacksaw.

6. The wheel being forced into the pipe as the tool is rotated around the pipe.

7. Inside burrs make it difficult to pull circuit wires and outside burrs make it difficult to thread pipe or conduit.

8. To remove burrs from inside a pipe and for countersinking and enlarging holes in sheetmetal.

9. It is cone shaped.

10. Some are adaptable for use in a brace, others with a ratchet, and some with an electric drill.

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES: Learning About Test Lights and Wood Chisels

1. T
2. T
3. F (it must be a known live circuit)
4. T
5. F
6. T
7. F
8. T
9. T
10. F

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES: What Materials Are Used By Electricians?

Evaluated to the satisfaction of the instructor.

ANSWERS TO ASSIGNMENT SHEETS

ELECTRICAL TRADES I

THEORY OF ELECTRICITY

THEORY OF ELECTRICITY: Basic Electrical Circuits

1. 120 times
2. It is more efficient because of its continuous flow at the same value.
3. Direct current flows in a path continuously in the same direction, while alternating current changes direction at regular intervals.
4. voltage
5. It can be moved over long distances by using transformers and has more widespread applications at a much lower cost.

THEORY OF ELECTRICITY: Fundamentals of Electricity

1. An atom is the smallest part of an element that can take part in ordinary chemical changes
2. An atom has a nucleus around which one or more electrons revolve.
3. Electrons are negative, protons are positive
4. The number and arrangement of the electrons, protons, and neutrons.
5. Valence shell
6. The attracting force of the positive nucleus of an atom weakens with distance. This makes it easier for the electrons revolving in the valence shell to move out of their orbit.
7. Because less energy is required to move the electron out of its orbit.
8. Gold is the best conductor because a gold atom has six shells.
9. Aluminum is not a good conductor because aluminum has three valence electrons.
10. When weight is a major consideration.
11. More atoms are present in a large cross section.
12. Strands are used when flexibility is necessary.
13. Having eight electrons in their valence shell.

14. It tends to empty its valence shell by giving up its valence electrons.

15. It tends to fill its valence shell by collecting electrons.

THEORY OF ELECTRICITY: Generating Electrical Current

1. An electromagnet is made by wrapping an electrical conductor around an iron core.

2. The strength or intensity of the magnetic field around a current-carrying conductor increases when the current increases, and decreases when the current decreases.

3. The direction of the current through the conductor.

4. It increases the induced voltage.

5. It increases the induced voltage.

6. It increases the induced voltage.

7. at "start" and "1/2 cycle"

8. at "1/4 cycle" and "3/4 cycle"

9. it is in an opposite direction

10. It is of opposite polarity.

THEORY OF ELECTRICITY: Units of Electrical Measurement

1. To measure the quantity of electron flow.

2. To measure the rate, or intensity, of current flow.

3. An ampere is one coulomb per second.

4. an ohm

5. An ohm is the amount of resistance that will permit one volt to push one ampere.

6. an mho

7. It has a greater ability to conduct electricity.

8. It has a great number of free electrons.

9. E - electromotive force or voltage applied across the conductor
I = intensity of current flow or amperes through the conductors
R = resistance (in ohms) of the conductor, depending on the material of which the conductor is made, its physical dimensions (length and cross-sectional area), and temperature.

10. $E = I X R$
$I = E/R$
$R = E/I$

ANSWERS TO ASSIGNMENT SHEETS

ELECTRICAL TRADES I

GENERATING AND DISTRIBUTING ELECTRICAL POWER

GENERATING AND DISTRIBUTING ELECTRICAL POWER: Generating Electricity

1. Electricity is the flow of electrons along a conductor.
2. Electricity is produced when two materials are rubbed together.
3. Electricity is produced when pressure is applied to a crystal.
4. Electricity is produced when heat is applied to the junction of two dissimilar metals.
5. Electricity is produced when light strikes a photosensitive material.
6. Electricity is produced when a chemical action takes place between two metals in a cell.
7. Electricity produced by light is used in cameras, spacecraft, and in radios.
8. Batteries are used in flashlights, radios, hearing aids, and in calculators.
9. Crystal pickups are used in inexpensive record players.
10. In the manufacturing of sandpaper and in cleaning polluted air.

GENERATING AND DISTRIBUTING ELECTRICAL POWER: Sources of Electrical Power

1. (Answers may be in any order)

   a. Hydro-electric plants
   b. Gas-fired plants
   c. Coal-fired plants
   d. Atomic generating plants

2. (Answers may be in any order)

   a. Wind-powered
   b. Gasoline-powered
   c. Solar-powered

3. (Answers may be in any order)

   a. Publicly owned
   b. Privately owned
   c. Cooperatives

4. (Answers may be in any order)

   a. Transmission lines--electrical lines that extend from generating plants to substations or distribution centers

b. Distribution lines--begin at the sub-station or distribution center and extend to the user

c. Service lines--run from the meter to the point of use

GENERATING AND DISTRIBUTING ELECTRICAL POWER: Uses of Electrical Power

1. Answers may be in any order. Uses of electrical service will be evaluated to the satisfaction of the instructor.

2-3. Evaluated to the satisfaction of the instructor.

ANSWERS TO ASSIGNMENT SHEETS

ELECTRICAL TRADES I

ELECTRICAL CODES

ELECTRICAL CODES: History of the National Electrical Code

1. T
2. F
3. F
4. T
5. F

ELECTRICAL CODES: Using the National Electrical Code

1. 240-4
2. 250-45
3. 430-G
4. 210-7, 250-60(d)
5. 220-3(b)
6. 370-18(c)
7. 240-6
8. 445-4
9. 400-8
10. 338-4

ANSWERS TO ASSIGNMENT SHEETS

ELECTRICAL TRADES I

BLUEPRINTS AND SCHEMATIC DIAGRAMS

BLUEPRINTS AND SCHEMATIC DIAGRAMS: What is a Blueprint?

1. working drawing
2. picture, symbols, explanations
3. A. device to be used
   B. where the device will be placed
   C. if switches control the device
4. one, three
5. engineer

BLUEPRINTS AND SCHEMATIC DIAGRAMS: Symbols

1. Duplex Convenience Receptacle
2. 240v Outlet
3. Single Pole Switch
4. Ceiling Lamp Holder
5. Three Way Switch
6. Four Way Switch
7. Range Receptacle
8. Automatic Door Switch
9. Switch and Pilot Lamp
10. Special Purpose Receptacle
11. Lighting Panel
12. Push Button
13. Power Transformer
14. Outside Telephone
15. Bell
16. Home Run to Panel Board
17. Switch Leg of Circuit
18. Floor Receptacle
19. Fire Alarm Bell
20. Ceiling Outlet for Recessed Fixture

BLUEPRINTS AND SCHEMATIC DIAGRAMS: Reading a Ruler

1. 1 1/4
2. 1 7/8
3. 3 1/8
4. 1 1/8
5. 4 1/8
6. 9/16
7. 15/16
8. 1 13/16
9. 2 3/16
10. 3 7/16

BLUEPRINTS AND SCHEMATIC DIAGRAMS: Blueprint Scale

1. 3 inches
2. 7 inches
3. 5 inches
4. 13 inches
5. 8 inches

BLUEPRINTS AND SCHEMATIC DIAGRAMS: Blueprint Lines

1. C
2. E
3. B
4. G
5. H
6. A
7. F
8. D

BLUEPRINTS AND SCHEMATIC DIAGRAMS: Architect's Plans

1. Shows the house and the position of the house on the lot.
2. Shows the outside of the house and interior walls which need to be explained.
3. Show the wall positions of the house, fixture position, and device positions.
4. Show objects which need to be explained further.
5. Are cut-away drawings showing inside walls and other drawings.

BLUEPRINTS AND SCHEMATIC DIAGRAMS: Schematic Diagrams

1. power source
2. pathway or wire
3. load or resistor
4. switch
5. load or resistor

BLUEPRINTS AND SCHEMATIC DIAGRAMS: Types of Schematic Diagrams

1 Evaluated to the satisfaction of the instructor.

2. A. parallel
   B. complex
   C. series
   D. series

ANSWERS TO ASSIGNMENT SHEETS

ELECTRICAL TRADES I

PLANNING THE JOB

PLANNING THE JOB: Terms and Definitions for Residential Service

1. The conductors dropping from the pole to the point of attachment on the residence.
2. The underground conductors from the transformer or street junction to the residence.
3. The conduit, gutter, or other enclosure that covers service conductors.
4. Conductors running from transformer to service entrance equipment. This can be an overhead or underground (lateral) system.
5. The conduit that rises in the air in which service conductors attach to drop.
6. Device which prevents water from entering the service mast.
7. Box where the terminals are fixed for service entrance conductors to feed the meter.
8. Device that reads the wattage used at the residence.

PLANNING THE JOB: Identifying Parts of an Overhead Service

1. weather head
2. service conductors
3. mast or service raceway
4. strap
5. hub
6. meter base
7. lugs (line side)
8. neutral lugs
9. lugs (load side)
10. bushings around pipe nipple

PLANNING THE JOB: Understanding the Process of Roof Penetration

1. T
2. F
3. T
4. T
5. T

PLANNING THE JOB

PLANNING THE JOB: Planning an Overhead Service

Evaluated to the satisfaction of the instructor.

PLANNING THE JOB: The Underground Service Entrance

Evaluated to the satisfaction of the instructor.

PLANNING THE JOB: Figuring Demand Ratings

1. 3,000 sq. ft.
   x 3 w/sq. ft.
   9,000 watts
   +3,000 watts - small appliance kitchen loads
   +1,500 watts - small appliance laundry load
   13,500 watts
   -3,000
   10,500
   x .35
   3,675
   +3,000
   6,675 watts

2. 27,000 sq, ft,
   x 3 w/sq. ft.
   81,000
   3,000
   1,500
   85,500
   -3,000
   82,500
   x .35
   28,875 watts
   +3,000 watts
   31m875 watts

PLANNING THE JOB: Figuring Demand Ratings for Ranges

1. 16.7 kw
   -12.0 kw
   4.7 kw
   (round up)
   5.0 kw
   x .05
   .25

   8,000 watts - column A
   - 1.25
   10,000 watts or 10 kw

2. 14 kw
   -12 kw
   2 kw
   x .05
   .10

8,000 x 1.10 = 8,800 watts or 8.8 kw

3. 11 kw (not over 12 kw so it is figured at 8,000 watts)

PLANNING THE JOB: Figuring Demand Ratings for Dryers and Household Appliances

1. 5,000 watts
2. 5,000 watts
3. 5,050 watts
4. 8,000 watts

5. 7.8a x 120v x .75 = 702 watts
6. 9a x 120v x .75 = 810 watts
7. 12a x 120v x .75 = 1,080 watts
8. 16a x 120v x ,75 = 1,440 watts

9. 6a x 120v (not x .75) = 720 watts
10. 11a x 120v = 1,320 wats
11. 4a x 120v = 480 watts

12. 28 x 120v (not .75) = 3,3360 watts
13. 2 x 7 x 120v = 1,680 watts
14. 12 x 120v = 1,440 watts

PLANNING THE JOB: Figuring Demand Ratings for a Single Family Dwelling

UNIT	WATTAGE	DIVISOR	PHASE LOAD	NEUTRAL LOAD
General Purpose	2,000 x 3 = 6,000w + 4,500 w = 10,500 w derate 3,000 + 2,625 = 5,625w	240v	23.4a	23.4a
Range	13.6kw 1.6kw Rd. up to 2kw 2kw x .05 = .10 8,000 x 1.10 = 8.8kw	240v	36.66a	25.66a
Dryer	4,000 watt -5,000 watts	240v	20.83a	14.58a
Dishwasher	7.4 x 120v x .75 = 666w	240v	2.77a	2.77a
AC Unit	23a x 240v = 5,520 w	240v	23a	---
Heating	60a x 240v = 14,400 w	240v	60a	---
Garbage Disposal	4a x 120v x .75 = 360w	240v	1.5a	1.5a
Trash Compactor	8a x 120v x .75 = 720w	240v	3a	3a
Garage Door Opener	6a x 120v x .75 = 540w	240	2.25a	2.25a
Largest Motor Load	trash comp. 8amp x 120v = 960w 960 w x .25 = 240w	240v	1a	1a
			151.44a	74.19a

ANSWERS TO ASSIGNMENT SHEETS

ELECTRICAL TRADES I

ELECTRICAL INSTALLATION

ELECTRICAL INSTALLATION: Terms and Definitions for Electrical Installation

1. wire
2. electrical cable
3. cord
4. wire size
5. wire gauge number
6. ground wire
7. hot wire
8. neutral wire
9. junction box
10. outlet box
11. terminal
12. duplex receptacle
13. single pole switch
14. three-way switch
15. wiring plan
16. branch circuit

ELECTRICAL INSTALLATION: Connectors

1. Electrical splices and electrical connections are the trouble makers and weak points in an electrical circuit.

2. Electrical splices and electrical connections must be mechanically secure and electrically secure.

3. Joining the ends of two wires or cables either by mechanically twisting them together or by using a special splicing device.

4. There are three types of pigtail splices - taped, two wire solderless, and multiple wire solderless.

5. Taping is necessary to prevent oxidation of the splice, as well as shocking, and possibly shorting out.

6. One wrap will take care of voltage up to 600 volts.

7. Plastic tape is stretched as it is applied in order to secure the tape more firmly.

8. Solderless connectors are used a great deal for electrical splices in outlets and junction boxes.

9. Solderless connectors are selected for size depending upon the size of wire to be joined and the number of wires to be joined.

10. The Western Union splice is used when solid conductors must carry their own weight for a considerable span or when conductors are too large for a pigtail splice.

11. The tee tap splice is used to connect one wire to a continuous run of another wire.

12. The solder has 60% tin and 40% lead.

13. The tin is the solder is for strength.

14. Heat sources for solder include: soldering iron, propane torch, and soldering gun.

15. It allows the solder to flow toward the heat.

16. Fine sandpaper, emery cloth, or fluxing it as it is heated cleans the splice.

17. Fast cooling of a soldered splice removes all the strength from the solder.

18. It is used to join cables of large size.

19. It is a metal cap which is slipped over wires. Crimping pliers are then used to crimp wires and thimble together.

20. Non-insulated terminals have for the most part replaced small lugs which are soldered to the wire.

ELECTRICAL INSTALLATION: Learning About Conductors

Evaluated to the satisfaction of the instructor.

ELECTRICAL INSTALLATION: Identify Electrical Service Entrance Parts

1. lead wires
    a. Hot wires
    b. Neutral wires
2. Entrance head
3. Meter box
4. Entrance ell
5. Neutral bar
6. Single-pole breaker
7. Two-pole breaker
8. Main breaker
9. Panel
10. Conduit

ELECTRICAL INSTALLATION: Pulling Cable

1. Holes should be drilled as straight as possible and in the center.

2. A steel plate of at least 1/16 - inch thick must be used to cover the notch.

3. a. Drill holes from each side at an angle.
    b. Notch the corner studs.
    c. Route cable under the corner.
    d. Route cable over the corner.
    e. To avoid wasting of cable.

ELECTRICAL INSTALLATION: Box Identification and Installation

1. (Any four of the following)

   a. Metal
   b. Plastic
   c. Fiber
   d. Nylon
   e. Rubber

2. a. Handy--used for splices, switches, pull boxes
   b. Outlet--used for switches and receptacles
   c. Octagon--used mainly for lighting
   d. Square--used for special purpose switch-receptacle combination

3. a. T
   b. T
   c. F
   d. F
   e. T
   f. T
   g. T
   h. T
   i. T
   j. T

4. a. Find where outlet box should go.
   b. Find box mounting holes and recess depth mark on box.
   c. Decide which nail holes to use.
   d. Hold box in desired position with depth mark even with edge of stud.
   e. Drive nails through holes.
   f. Check box to be sure it is held tightly in place.

5. a. Nail on switch box
   b. Bracket box
   c. Octagon box with bar hanger
   d. Square box--welded construction
   e. Square box--molded construction
   f. Metallic cable clamp
   g. Pri out
   h. Clip
   i. Screw with pigtail
   j. Non-metallic cable clamp

ELECTRICAL INSTALLATION: Installation of Switches

1. a. Silver-colored screws indicate neutral.
   b. Bronze-colored screws indicate the hot terminal.
   c. Green screws indicate the ground terminal.

2. a. Single pole switch
   b. Three-way switch
   c. Dimmer switch
   d. Push-button switch

ELECTRICAL INSTALLATION: Installation of Receptacles

1.
   - a. mounting screw
   - b. ungrounded contact slot (narrow)
   - c. grounded contact slot (wide)
   - d. grounded terminals (white)
   - e. grounding contact slot (semi-oval)
   - f. strap or yoke
   - g. ungrounded terminal (cooper)
   - h. break-off fin
   - i. grounding terminal

2.
   - a. Remove outside cable insulation about 6 inches.
   - b. Strip at least 1 to 1 1/2 inches of insulation from inner cables.
   - c. Make a loop on the end of each wire.
   - d. Attach the wire loops on the end of each wire.
   - e. Fasten the receptacle to the box and attach cover.

ELECTRICAL INSTALLATION: Identifying Parts of a Fluorescent Lamp Fixture

1. Fixture
2. Bulb
3. Ballast
4. Starter
5. Holder

ELECTRICAL INSTALLATION: Identifying Parts of a Pipe-Supported Lamp Fixture

1. Fixture strap
2. Strap mounting screw
3. Threaded pipe
4. Multiple socket
5. Locknut

EXTERNAL INSTALLATION: External Installation

1. F
2. T
3. T
4. T
5. T
6. T
7. F
8. T
9. T
10. T

ANSWERS TO ASSIGNMENT SHEETS

ELECTRICAL TRADES I

TROUBLESHOOTING

TROUBLESHOOTING: Troubleshooting Tools

1. B
2. C
3. A
4. D

ANSWERS TO ASSIGNMENT SHEETS

ELECTRICAL TRADES I

COMMON ESSENTIAL ELEMENTS

COMMON ESSENTIAL ELEMENTS/LEADERSHIP: Leadership Terms and Definitions

1. motivation
2. communicate
3. optimistic
4. autocratic
5. leadership
6. dependable
7. maturity
8. initiative
9. strength of conviction
10. democracy

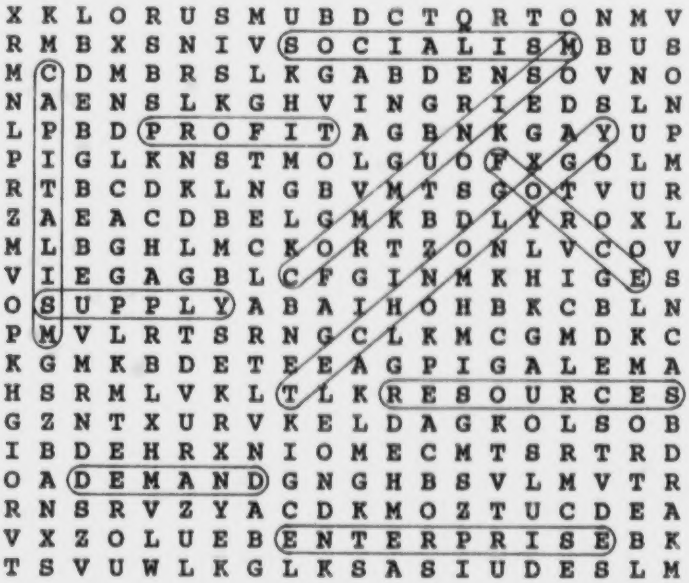
COMMON ESSENTIAL ELEMENTS/LEADERSHIP: Planning and Conducting a Meeting

Evaluated to the satisfaction of the instructor.

COMMON ESSENTIAL ELEMENTS/EMPLOYMENT: Employment Terms and Definitions

Evaluated to the satisfaction of the instructor.

COMMON ESSENTIAL ELEMENTS/ENTREPRENEURSHIP: Entrepreneurship Terms and Definitions



X K L O R U S M U B D C T Q R T O N M V
R M B X S N I V S O C I A L I S M B U S
M C D M B R S L K G A B D E N S O V N O
N A E N S L K G H V I N G R I E D S L N
L P B D P R O F I T A G B N K G A Y U P
P I G L K N S T M O L G U O F X G O L M
R T B C D K L N G B V M T S G O T V U R
Z A E A C D B E L G M K B D L Y R O X L
M L B G H L M C K O R T Z O N L V C O V
V I E G A G B L C F G I N M K H I G E S
O S U P P L Y A B A I H O H B K C B L N
P M V L R T S R N G C L K M C G M D K C
K G M K B D E T E E A G P I G A L E M A
H S R M L V K L T L K R E S O U R C E S
G Z N T X U R V K E L D A G K O L S O B
I B D E H R X N I O M E C M T S R T R D
O A D E M A N D G N G H B S V L M V T R
R N S R V Z Y A C D K M O Z T U C D E A
V X Z O L U E B E N T E R P R I S E B K
T S V U W L K G L K S A S I U D E S L M

COMMON ESSENTIAL ELEMENTS/ENTREPRENEURSHIP: Am I an Entrepreneur?

Evaluated to the satisfaction of the instructor.

COMMON ESSENTIAL ELEMENTS/ENTREPRENEURSHIP: Starting Your Own Business

Evaluated to the satisfaction of the instructor.

COMMON ESSENTIAL ELEMENTS/GENERAL SHOP SAFETY: Personal and Group Safety

1. accidents
2. attitude
3. attitudes, personal
4. accidents
5. Occupational Safety and Health Act
6. alert
7. avoided, accident-prone
8. injury
9. conditions, practices, others
10. actions, you, classmates

COMMON ESSENTIAL ELEMENTS/GENERAL SHOP SAFETY: Work Safety in the Shop

1. F
2. T
3. T
4. F
5. F
6. F
7. T
8. F
9. T
10. T
11. F
12. T
13. T
14. F
15. F

COMMON ESSENTIAL ELEMENTS/GENERAL SHOP SAFETY: Fire Safety

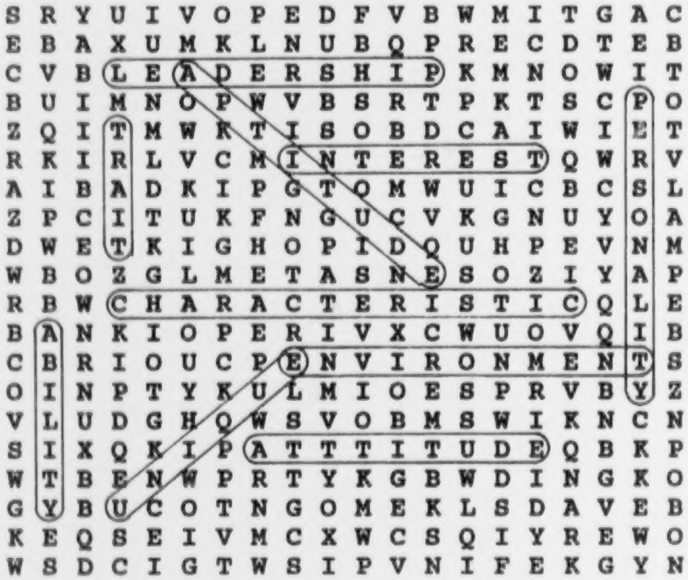
Evaluated to the satisfaction of the instructor.

COMMON ESSENTIAL ELEMENTS/GENERAL SHOP SAFETY: Safety with Hand and Power Tools

1. Hand
2. Power
3. attention
4. best
5. dry
6. off
7. off
8. three-wire
9. Do not
10. off

COMMON ESSENTIAL ELEMENTS/HUMAN RELATIONS AND PERSONALITY DEVELOPMENT: Terms and Definitions for Human Relations and Personality Development

1. interest
2. trait
3. leadership
4. aptitude
5. personality
6. environment
7. attitude
8. ability
9. unique
10. characteristic



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S R Y U I V O P E D F V B W M I T G A C
E B A X U M K L N U B Q P R E C D T E B
C V B L E A D E R S H I P K M N O W I T
B U I M N O P W V B S R T P K T S C P O
Z Q I T M W K T I S O B D C A I W I E T
R K I R L V C M I N T E R E S T Q W R V
A I B A D K I P G T O M W U I C B C S L
Z P C I T U K F N G U C V K G N U Y O A
D W E T K I G H O P I D Q U H P E V N M
W B O Z G L M E T A S N E S O Z I Y A P
R B W C H A R A C T E R I S T I C Q L E
B A N K I O P E R I V X C W U O V Q I B
C B R I O U C P E N V I R O N M E N T S
O I N P T Y K U L M I O E S P R V B Y Z
V L U D G H Q W S V O B M S W I K N C N
S I X Q K I P A T T T I T U D E Q B K P
W T B E N W P R T Y K G B W D I N G K O
G Y B U C O T N G O M E K L S D A V E B
K E Q S E I V M C X W C S Q I Y R E W O
W S D C I G T W S I P V N I F E K G Y N
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COMMON ESSENTIAL ELEMENTS/HUMAN RELATIONS AND PERSONALITY DEVELOPMENT: Self-Concept Checklist

Evaluated to the satisfaction of the instructor.

COMMON ESSENTIAL ELEMENTS/PERSONAL AND BUSINESS MANAGEMENT: Terms and Definitions for Personal and Business Management

Across

1. collateral
5. certified
6. needs
7. endorsement
9. gross
10. inflation
14. serial
15. counterfeit
17. reconciling
18. bank
19. signature

Down

1. canceled
2. loan
3. voiding
4. denomination
8. deposit
11. interest
12. service
13. overdraft
16. wants

COMMON ESSENTIAL ELEMENTS/PERSONAL AND BUSINESS MANAGEMENT: Budgets

Evaluated to the satisfaction of the instructor.

APPENDIX D

ANSWERS TO PRE/POSTTEST

ANSWERS TO PRE/POSTTEST

ELECTRICAL TRADES I

SAFETY

1. a. Any unplanned event which causes injury or damage
   b. Electric current passing through a person's body
   c. Current carrying wire
   d. A connection to earth which serves as a return circuit and reduces danger
   e. A side current caused by bad wiring so that the electric current is turned aside from the main circuit

2. a. It reduces its resistance
   b. Large wire allows more, small wires allow less
   c. People differ in their resistance to electricity
   d. Water reduces resistance and the chance of electrocution is much greater
   e. A regular schedule of inspection and maintenance
   f. Prospect the person who helps an accident victim
   g. Direct pressure
   h. Bad safety attitudes
   i. Rubber or plastic gloves
   j. Accident prevention
   k. Hazards of the job
   l. They are dangerous and should not be worn
   m. Protection for the feet and slip resistance
   n. In the pockets
   o. Sight and hearing
   p. 85 to 90 decibels
   r. Lungs and skin

s. Ten pounds or less

t. Good tools reduce the dangers involved

u. Toward the movable jaw

v. Two cords to carry current and one to ground the tool

w. Only when absolutely necessary

x. With the power disconnected and the line rolled up

y. Preventing one from starting

ANSWERS TO PRE/POSTTEST

ELECTRICAL TRADES I

INTRODUCTION TO ELECTRICAL TRADES

1. a Electrical current flowing one way at steady spaces in time
   b. A unit for measuring the strength of an electric current
   c. A device which measures the amount of electricity used
   d. A unit of mechanical power which is the same as 746 watts of electrical power
   e. One watt used for one hour

2. a. F
   b. T
   c. F
   d. T
   e. T

ANSWERS TO PRE/POSTTEST

ELECTRICAL TRADES I

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES

1. a. Quality tools will last much longer and will consistently provide good results.

   b. Curved handles
   Hand form handles
   Extended handles

   c. Curved handles

   d. If too light a plier is used or if cheaters are used to give extra length to plier handles.

   e. The knives may be dull, or perhaps a plier of greater leverage is needed.

2. a. phillips

   b. pressure put on them

   c. concave

   d. climb out

   e. phillips

3. a. F

   b. T

   c. T

   d. T

   e. T

4. a. chuck

   b. center

   c. course screw

   d. 1"

   e. metal

5. a. T

b. F

c. T

d. T

e. T

6. a. Fish tape is used to pull wires through conduit and through wall or ceiling openings.

b. One with a thickness of .606" and width of 1/8".

c. Off-set, saddle, right-angle, etc.

d. Inside burrs make it difficult to pull circuit wires and outside burrs make it difficult to thread pipe or conduit.

e. By holding conduit in a fixed position and moving the hickey or by holding the hickey in a fixed position and shaping the conduit to the hickey.

ANSWERS TO PRE/POSTTEST

ELECTRICAL TRADES I

THEORY OF ELECTRICITY

1. a. 120 times

   b It is more efficient because of its continuous flow at the same value.

   c. Direct current flows in a path continuously in the same direction, while alternating current changes direction at regular intervals.

   d. An atom has a nucleus around which one or more electrons revolve.

   e. Valence shell

   f. Gold is the best conductor because a gold atom has six shells.

   g. Having eight electrons in their valance shell.

   h. An electromagnet is made by wrapping an electrical conductor around an iron core.

   i. The direction of the current through the conductor.

   j. It increases the induced voltage.

   k. To measure the quantity of electron flow.

   l. An ampere is one coulomb per second.

   m. an ohm

   n. an mho

   o. To measure the rate, or intensity, of current flow.

ANSWERS TO PRE/POSTTEST

ELECTRICAL TRADES I

GENERATING AND DISTRIBUTING ELECTRICAL POWER

1. a. Electricity is the flow of electrons along a conductor.

   b. Electricity is produced when two materials are rubbed together.

   c. Electricity is produced when pressure is applied to crystal.

   d. In the manufacturing of sandpaper and in cleaning polluted air.

   e. Electricity is produced when a chemical action takes place between two metals in a cell.

2. (Answers may be in any order)

   a. Hydro-electric plants

   b. Gas-fired plants

   c. Coal-fired plants

   d. Atomic generating plants

3. Evaluated to the satisfaction of the instructor.

ANSWERS TO PRE/POSTTEST

ELECTRICAL TRADES I

ELECTRICAL CODES

1. a. T
   b. F
   c. F
   d. T
   e. F

ANSWERS TO PRE/POSTTEST

ELECTRICAL TRADES I

BLUEPRINTS AND SCHEMATIC DIAGRAMS

1. a. working drawing
   b. picture, symbols, explanations
   c. one, three
   d. engineer

2. a. Duplex convenience receptacle
   b. Three way switch
   c. Push button
   d. Special purpose receptacle
   e. 240v outlet

3. a. 1 3/8
   b. 3 1/8
   c. 4 5/8
   d. 1 1/8

4. a. 1 1/4
   b. 2 3/4
   c. 3 1/4
   d. 3 3/4

5. a. parallel
   b. series

ANSWERS TO PRE/POSTTEST

ELECTRICAL TRADES I

PLANNING THE JOB

1. a. The conductors dropping from the pole to the point of attachment on the residence.

   b. The conduit, gutter, or other enclosure that covers service conductors.

   c. The conduit that rises in the air in which service conductors attach to drop.

   d. Device which prevents water from entering the service mast.

   e. Device that reads the wattage used at the residence.

2. a. T
   b. F
   c. T
   d. T
   e. T

ANSWERS TO PRE/POSTTEST

ELECTRICAL TRADES I

ELECTRICAL INSTALLATION

1. a. A covered outlet box used to enclose splices within a circuit
   b. The number that determines the size of the wire from 4/0 to 14
   c. Usually black but can be any color except green; always has voltage applied to it
   d. Usually bare or green wire that connects circuit to earth for safety
   e. A switch to control a circuit from two places

2. a. Electrical splices and electrical connections are the troublemakers and weak points in an electrical circuit.
   b. Joining the ends of two wires or cables either by mechanically twisting them together or by using a special splicing device.
   c. Plastic tape is stretched as it is applied in order to secure the tape more firmly.
   d. The tee tap splice is used to connect one wire to a continuous run of another wire.
   e. It is a metal cap which is slipped over wires. Crimping pliers are then used to crimp wires and thimble together.
   f. Holes should be drilled as straight as possible and in the center.
   g. To avoid wasting of cable
   h. A steel plate of at least 1/16 - inch thickness must be used to cover the notch.
   i. Non-insulated terminals have for the most part replaced small lugs which are soldered to the wire.
   j. Fine sandpaper, emery cloth, or fluxing it as it heated cleans the splice.

3. a. T
   b. F

c. T

d. T

e. T

4. a. Silver-colored screws indicate neutral

   b. Bronze-colored screws indicate the hot terminal

   c. Green screws indicate the ground terminal

5. a. F

   b. T

   c. T

   d. T

   e. T

ANSWERS TO PRE/POSTTEST

ELECTRICAL TRADES I

TROUBLESHOOTING

1. a. voltage tester
   b. voltmeter
   c. neon tester
   d. amp clamp

APPENDIX E

PRE/POSTTEST

PRE/POSTTEST

ELECTRICAL TRADES I

SAFETY

NAME: ______________________________ DATE: ______________

1. Give the definition of each of the following terms in the space provided.
    a. Accident
    b. Electrical shock
    c. Live wire
    d. Ground
    e. Short circuit

2. Read and answer each of the following questions in the space provided.
    a. What effect does moisture have on an insulator?
    b. How does the wire size affect current flow?
    c. Why will the same amount of electricity kill some people but not others?

d. One should never touch anything electrical while standing in water, or even with wet clothing on. Why?

e. What is the main line of defense against electrocution?

f. In a few words, what does the Texas Good Samaritan Law do?

g. What is the usual method of controlling bleeding quickly?

h. What is the single largest cause of accidents?

i. What is the protection to wear when mixing chemicals?

j. What is the purpose of safety rules?

k. What should be considered when buying work clothes?

l. What do rings, bracelets, neckties, and loose clothing have in common concerning an industrial shop?

m. What are the two important functions of foot wear?

n. Where should sharp, pointed objects never be carried?

o. Name the two most important senses that we have.

p. At what sound level can ear damage start?

q. Name the internal and external organs of respiration.

r. How long can brain cells live without oxygen?

s. Most back injuries are caused by lifting how much weight?

t. Why should one use only tools in good condition?

u. In what direction should one pull an adjustable wrench?

v. Electrical power tools almost always have a three cord conductor. Why?

w. When should one lock a power tool in the "on" position?

x. When is it safest to work on a machine?

y. What is the best fire protection?

PRE/POSTTEST

ELECTRICAL TRADES I

INTRODUCTION TO ELECTRICAL TRADES

NAME:____ DATE:______________

1. Give the definition of each of the following terms in the space provided.

   a. Alternating current

   b. Circuit breaker

   c. Electric meter

   d. Horsepower

   e. Watt hour

2. Read each of the following statements. If the statement is true, circle the T. If the statement is false, circle the F.

   T F a. Residential electricians work only on new buildings.

   T F b. Electricians are often required to work in crawl spaces or attics.

   T F c. Electricians work independently and do not require any type of approval on their work.

   T F d. A four-year apprenticeship program is recommended for electricians.

   T F e. Electricians may learn through informal on-the-job training.

PRE/POSTTEST

ELECTRICAL TRADES I

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES

NAME:____ DATE:_______________

1. Read and answer each of the following questions in the space provided.

   a. What are the advantages of buying quality tools?

   b. What are the types of handles that pliers are equipped with?

   c. Which type of handle gives greater control over a plier?

   d. What is meant by pushing pliers beyond their capacity?

   e. If a plier will not cut through a wire readily, what are the usual causes?

2. Read each of the following statements. Complete each sentence by placing the correct word in the blank.

   a. The two most widely used screwdrivers are the standard blade and the _______________ head.

   b. Screwdriver tips are heat-treated to withstand wear and _______________.

   c. A correctly ground common screwdriver blade has the sides slightly _______________.

   d. A screwdriver blade that has been ground at too steep an angle will tend to twist or _______________ of the slot.

   e. The screwdriver with an X-shaped tip is a _______________ screwdriver.

3. Read each of the following statements. If the statement is true, circle the T. If the statement is false, circle the F.

T F a. Handsaws most commonly found in the electrician's tool box are the ripsaw, keyhole saw, and power saw.

T F b. The number stamped on the heel of the saw is the number of teeth per inch.

T F c. Teeth are set on a handsaw to give the cutting side more rigidity and strength.

T F d. A keyhole saw has rip teeth.

T F e. Hacksaw blades come in lengths of 8", 10", and 12".

4. Read each of the following statements. Complete each sentence by placing the correct word in the blank.

a. The size of an electric portable drill is determined by the ______________ size.

b. To drill a hole, position the point of the drill on the ______________ of the hole to be drilled.

c. The electrician usually uses an auger bit with ______________ threads.

d. Expansion bits are used to bore holes in excess of ______________.

e. High speed twist drills are used for drilling ______________.

5. Read each of the following statements. If the statement is true, circle the T. If the statement is false, circle the F.

T F a. Claw hammers are sized by the weight of the head.

T F b. The straight claw hammer is adapted for pulling nails and other fasteners.

T F c. The plain face claw hammer is used for rough work.

T F d. To use a hammer, the handle is grasped near the end.

T F e. A lineman's hammer is designed so that it can be used in confined places.

6. Read and answer each of the following questions in the space provided.

a. What are two uses for which fish tape is used?

b. What is the most used size of fish tape?

c. What are the type of bends made with a hickey?

d. Why remove burrs from pipe or conduit?

e. What are two ways that a conduit bender is used to shape and form conduit bends?

PRE/POSTTEST

ELECTRICAL TRADES I

THEORY OF ELECTRICITY

NAME:____ DATE:______________

1. Read and answer each of the following questions in the space provided.

    a. How many times does alternating current change in one second?

    b. What is the advantage of using direct current instead of alternating current?

    c. How does direct current differ from alternating current?

    d. What does an atom consist of?

    e. What is the outer electron shell called?

    f. Why is gold a better conductor than copper?

    g. What makes an atom stable?

    h. How is an electromagnet made?

i. What determines the direction of the magnetic field?

j. How does increasing the number of turns (loops) in an electromagnet affect the induced voltage?

k. What is a coulomb used for?

l. What is an ampere?

m. What is used to measure resistance?

n. What is used to measure conductivity?

o. What does ampere measure?

PRE/POSTTEST

ELECTRICAL TRADES I

GENERATING AND DISTRIBUTING ELECTRICAL POWER

NAME: ______________________________ DATE: __________

1. Read and answer each of the following questions in the space provided.
   a. What is the definition of electricity?

   b. How is electricity produced using friction?

   c. How is electricity produced using pressure?

   d. Give an example of how electricity produced by friction is used.

   e. How is electricity produced using chemical actions?

2. List four types of electrical power plants.
   a.
   b.
   c.
   d.
3. List five ways in which you personally use electricity every day.
   a.
   b.

c.

d.

e.

PRE/POSTTEST

ELECTRICAL TRADES I

ELECTRICAL CODES

NAME:______________________________ DATE:______________

1. Read each of the following statements. If the statement is true, circle the T. If the statement is false, circle the F.

T F a. The proposal which served as a basis for the first National Electrical Code came out of a meeting held in Richmond, Virginia in 1881.

T F b. The first nationally recommended electrical code was published in 1901.

T F c. The Code is revised and updated every six years.

T F d. The Code is not intended as an instruction manual for untrained persons.

T F e. Under no circumstances are exceptions to the Code granted.

PRE/POSTTEST

ELECTRICAL TRADES I

BLUEPRINTS AND SCHEMATIC DIAGRAMS

NAME:______________________________ DATE:______________

1. Read each of the following statements. Complete each sentence by placing the correct word in the blank.

   a. A blueprint is a ____________ of an object that is to be constructed.

   b. Blueprints use ____________ with ____________ abbreviations, and written ____________ to parts of the drawings.

   c. Blueprints are ____________ dimensional plans showing ____________ dimensional objects.

   d. It is up to the ____________ to design where the devices are to be placed.

2. Correctly identify each of the following symbols.

   a. ____________________

   b. ____________________

   c. ____________________

   d. ____________________

   e. ____________________

3. Measure each of the following lines to the nearest 1/8 inch.

   a.

   b.

   c.

   d.

4. Measure each of the following lines to the nearest 1/4 inch.

   a.

   b.

c.

d.

5. Identify each of the following drawings as either a parallel or series circuit.

a. ____________________

b. ____________________

PRE/POSTTEST

ELECTRICAL TRADES I

PLANNING THE JOB

NAME:______________________________ DATE:______________

1. Define each of the following terms in the space provided.

   a. Service drop

   b. Service raceway

   c. Service mast

   d. Weatherhead

   e. Meter

2. Read each of the following statements. If the statement is true, circle the T. If the statement is false, circle the F.

T F a. The rubber boot slides over the raceway to seal flashing openings.

T F b. The flashing goes on top of the shingles.

T F c. A hole saw is used to drill the hole through the roof overhang.

T F d. A grounding clamp is used to clamp the grounding electrode conductor to the grounding electrode.

T F e. Tar should be used under the flashing.

PLANNING THE JOB

PRE/POSTTEST

ELECTRICAL TRADES I

ELECTRICAL INSTALLATION

NAME:____ DATE:______________

1. Give the definition of each of the following terms in the space provided.

    a. Junction box

    b. Wire gauge number

    c. Hot wire

    d. Neutral wire

    e. Three-way switch

2. Read and answer each of the following questions in the space provided.

    a. What are the weak points in an electrical system?

    b. Define electrical splice.

    c. Why stretch plastic insulation tape as it is applied?

d. For what purpose or purposes are "Tee" splices used?

e. What is a crimp-type connector?

f. How should holes be drilled in studs and floor joists prior to running cable?

g. Why should cable be pulled to its proper place and then cut for length?

h. When studs of floor joists are notched, what must be done?

i. When are "Non-Insulated" Terminals used?

j. What are the methods used for cleaning a splice prior to soldering?

3. Read each of the following statements. If the statement is true, circle the T. If the statement is false, circle the F.

T F a. Boxes are usually secured by nails.
T F b. Boxes must not be installed at cable splices.
T F c. Nails may be driven through back of box.
T F d. Boxes may be purchased with grounding clips.
T F e. Boxes may be bought with threaded holes for grounding screws.

4. What do silver-colored screws, bronze-colored screws, and green-colored screws on the receptacles and switches represent?

a. silver-colored

b. bronze-colored

c. green-colored

5. Read each of the following statements. If the statement is true, circle the T. If the statement is false, circle the F.

T F a. Wiring procedures used in external wiring are the same as used in internal wiring.

T F b. You may use standard receptacles and switches if they are mounted inside of special weather-proof housings.

T F c. UF cable is essentially weatherproof.

T F d. UF cable is preferred for outdoor wiring.

T F e. For added safety UF cable should be encased in rigid metal or plastic conduit.

PRE/POSTTEST

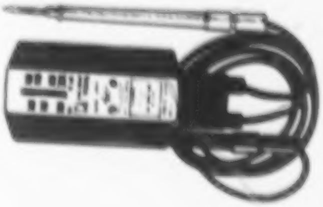
ELECTRICAL TRADES I

TROUBLESHOOTING

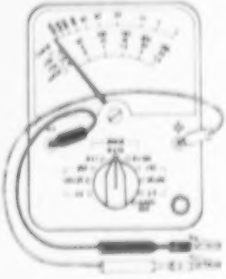
NAME:____ DATE:______________

1. Identify each of the following troubleshooting tools by placing the correct word in the blank.

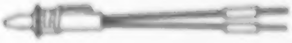
neon tester
voltmeter
voltage tester
amp clamp



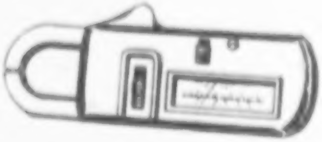
a. ______________



b. ______________



c. ______________



d. ______________

COMPLIANCE STATEMENT

TITLE VI, CIVIL RIGHTS ACT OF 1964; THE MODIFIED COURT ORDER, CIVIL ACTION 5281, FEDERAL DISTRICT COURT, EASTERN DISTRICT OF TEXAS, TYLER DIVISION

Reviews of local education agencies pertaining to compliance with Title VI Civil Rights Act of 1964 and with specific requirements of the Modified Court Order, Civil Action No. 5281, Federal District Court, Eastern District of Texas, Tyler Division are conducted periodically by staff representatives of the Texas Education Agency. These reviews cover at least the following policies and practices:

(1) acceptance policies on student transfers from other school districts;

(2) operation of school bus routes or runs on a non-segregated basis;

(3) nondiscrimination in extracurricular activities and the use of school facilities;

(4) nondiscriminatory practices in the hiring, assigning, promoting, paying, demoting, reassigning, or dismissing of faculty and staff members who work with children;

(5) enrollment and assignment of students without discrimination on the basis of race, color, or national origin;

(6) nondiscriminatory practices relating to the use of a student's first language; and

(7) evidence of published procedures for hearing complaints and grievances.

In addition to conducting reviews, the Texas Education Agency staff representatives check complaints of discrimination made by a citizen or citizens residing in a school district where it is alleged discriminatory practices have occurred or are occurring.

Where a violation of Title VI of the Civil Rights Act is found, the findings are reported to the Office for Civil Rights, Department of Health, Education and Welfare.

If there is a direct violation of the Court Order in Civil Action No. 5281 that cannot be cleared through negotiation, the sanctions required by the Court Order are applied.

TITLE VII, CIVIL RIGHTS ACT OF 1964; EXECUTIVE ORDERS 11246 AND 11375; TITLE IX, 1973 EDUCATION AMENDMENTS; REHABILITATION ACT OF 1973 AS AMENDED; 1974 AMENDMENTS TO THE WAGE-HOUR LAW EXPANDING THE AGE DISCRIMINATION IN EMPLOYMENT ACT OF 1967; AND VIETNAM ERA VETERANS READJUSTMENT ASSISTANCE ACT OF 1972 AS AMENDED IN 1974.

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ELECTRICAL TRADES I

Student Manual

OCCUPATIONAL CURRICULUM LAB · EAST TEXAS STATE UNIVERSITY

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ELECTRICAL TRADES I
STUDENT MATERIALS MANUAL

DEVELOPED
BY
SHELIA I. GRANT-GOLD, ED.D.

OCCUPATIONAL CURRICULUM LABORATORY
TRADE AND INDUSTRIAL EDUCATION
EAST TEXAS STATE UNIVERSITY

IN COOPERATION WITH

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UNIT II

SAFETY

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT:	Safety
TOPIC:	Electrical Safety Terms and Definitions
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will be able to match the terms and definitions associated with electrical safety.

Below is a list of terms and definitions which you should become familiar with before starting to work in the residential electrician trade. Study these terms until you are comfortable in discussing what each one means.

1. **Accident**--any unplanned event which causes injury or damage
2. **Approved**--said to meet the required standards
3. **Dead circuit**--a dissconnected circuit, usually caused by taking out a fuse, tripping a breaker, or unhooking service
4. **Defective**--not working correctly; faulty
5. **Electrical shock**--electric current passing through a person's body
6. **Ground**--a connection to the earth which serves as a return circuit and reduces danger
7. **Live wire**--current-carrying wire
8. **Modification**--a slight change in form or use
9. **Overload**--a circuit forced to carry more electric current than it is made to carry
10. **Qualified person**--a person who knows the work area involved
11. **Safety**--state of being free from danger, risk, or injury
12. **Short circuit**--a side current caused by bad wiring so that the electric current is turned aside from the main circuit

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________ **DATE:** ______________________

UNIT: Safety

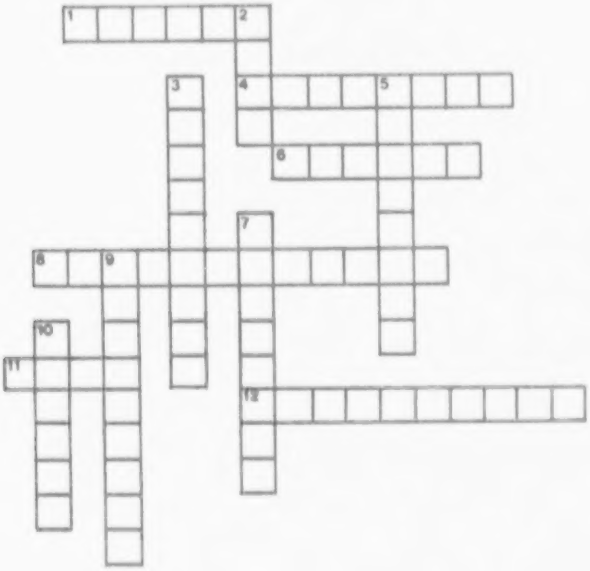
TOPIC: Electrical Safety Terms and Definitions

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will match the terms and definitions associated with electrical safety.

REFERENCE: Student Information Sheet/Electrical Safety Terms and Definitions

DIRECTIONS: Using the terms and definitions given on Student Information Sheet/Electrical Safety Terms and Definitions, complete the crossword puzzle below.



ACROSS

1. A connection to the earth which reduces danger.

DOWN

2. A ___ circuit is a disconnected circuit, usually caused by remov-

4. Meets the required standards established by authorities.

6. State or condition of being safe; free from danger, risk or injury.

8. A slight change in form or operation.

11. A ___ wire is a current carrying wire.

12. ____ shock is the result of electrical discharge through a person's body.

ing a fuse, tripping a breaker, or disconnecting the service.

3. A ___ person is one who is thoroughly familiar with the work area invloved.

5. A circuit or device forced to carry more electrical current than its design allows.

7. Any sudden, unplanned event which causes injury or property damage.

9. Not in proper working order.

10. A short ___ is an improper connection between hot wires or between hot and neutral wires.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT:	Safety
TOPIC:	Using Electricity Safely
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will be able to discuss the safe use of electricity.

Electricity is, without doubt, our most versatile form of energy. It heats and cools our homes, washes our clothes, and cooks our meals. It is hard to imagine any industrial operation being without it. Electricity is so simple that it can be produced with a coil of copper wire and a toy magnet. Yet, at the same time, it is so complicated that the greatest scientists disagree on many of its properties. Electricity is, indeed, one of the greatest servants of humanity. But it is also one that must be used with the greatest of caution. For this servant is ever waiting for the act of ignorance or carelessness that can spell death for its master.

GENERAL INFORMATION:

Since electricity is used for power in almost all, if not every industrial shop, everyone employed in one should know the principle of how it works.

Let us begin by comparing the flow of electrical current in a wire to the flow of water in a hose. The two are similar in some respects, but different in others. Water will flow through the hose if there is only one of them. But for electrons (electricity) to flow, there must be a return of "ground" line that carries it all the way back to where it was generated. That is why there are always at least two holes in a socket, where it was generated. That is why there are always at least two holes in a socket, two prongs on a plug, and two wires in a line. Electricity travels through one wire, does its work such as lighting a lamp or making a motor run, then the electricity that is left over returns in the other wire. This is called a complete or closed circuit. If the circuit is not complete because of a switch being off, one of the wires being parted, or for any other reason then it is called an open circuit.

Now you may ask this question, "My car lights have only one wire going to them. How does the electricity get back to the battery since there is no return line?" In this case the return line or ground is the frame and body of the car itself. The battery cable that bolts to the engine provides a pathway for the returning current.

Before going any further we should define some words commonly used when discussing electricity:

1. Conductor - This is anything that allows the flow of electric current through itself. It usually means a copper or aluminum wire through which the current is supposed to go, but the human body is also a good conductor.

2. Insulator - Some materials such as rubber or glass resist the flow of current and are called insulators. These are used to help control and direct electricity to where it is wanted.

3. Voltage - The amount of force or pressure in a line that keeps current flowing is its voltage. Most shops have circuits of both 120 and 240 volts.

4. Amperes - The rate of electricity flow through a wire is the amperes or amps. This is found by dividing the available voltage by the line's resistance.

5. Resistance - This is electrical friction that resists the flow of electrons. In wiring circuits it is a function of the size of the wire and the material it is made of - the larger the wire, the less resistance, and copper or aluminum wire has less resistance than steel. Resistance is stated in ohms.

6. Ground - We talked about the electrical ground earlier as the return wire in a circuit going back to the generator. This is so as long as electricity is controlled within the circuit. But if a pathway is available that is easier or shorter to travel, the current will follow it and go into the earth itself - thus, the name "ground". If a human body provides this pathway and the current is strong enough, the result may be electrocution and death.

SHOCKING FACTS

In the case of electrical shock a person's body actually becomes a part of the electric circuit. And the rate of flow or amperes of current through that circuit becomes a very important factor. Other considerations are; the path of the current through the body, length of time the body is part of the circuit, physical and mental condition of the person, and the phase of the heart cycle when the shock occurs.

Contrary to popular belief, it does not take a 220 or higher voltage circuit to be deadly. Consider a 60-cycle, 120 volt alternating current circuit such as may be found in almost any house. Under ideal conditions, such as a person with dry skin standing on a dry wood floor, the resistance to current flow would be about 100,000 ohms. Electricity passing through the skin would be calculated by dividing the voltage (120) by the resistance (100,000) and the result would be on the order of 0.001 amperes (1 milliampere). This might not even be felt. Now take that same voltage and a person with wet skin due to sweating who is standing on wet or damp ground. The resistance of the skin is reduced to 1,000 ohms. If we apply the same formula again--120 volts ÷ 1,000 ohms--we would come out with 0.1 of an ampere (100 milliamperes), and that is more than enough to kill.

There are few, if any, absolutes in figuring the injury that results from a given amount of amperage. But since over a thousand people are killed and thousands more injured in electrical accidents in industry every year, we can estimate from known facts learned from those accidents. These are stated in milliamperes which is a thousandth of one amp. Also, we are still on only 120 volts, alternating current:

0 -	1/2	milliampere	------	no sensation
1/2 -	2	milliamperes	------	barely felt
2 -	10	milliamperes	------	mild to strong muscle contraction
5 -	25	milliamperes	------	painful shock, contractions, cannot let go of wire
25 -	50	milliamperes	------	violent muscle contraction
50 -	200	milliamperes	------	ventricular fibrillation - heart goes into violent twitching, wringing action. Usually results in death.
over	100	milliamperes	------	breathing paralyzed - may survive with resuscitation.

You may note from the table that there is an overlap in a couple of places. This is due to the difference of resistance in people. Some people have a high degree of resistance while others have little. In fact, under certain conditions even a circuit of 50 volts can be dangerous. Other factors are the path of the current through the body and how long the body is in the circuit. It is important whether the electricity passes through the lungs and heart, and also how seriously the skin is burned. The more severe the burn, the less resistance the skin has.

ELECTRICAL HAZARDS

By now you should be firmly convinced of the need for safe working conditions and actions. Although it would be impossible to list all the electrical shock hazards one might find in industry, we can break them down into conditions and actions and list those that are most common.

Unsafe Conditions:

1. Extension and drop cords with worn or damaged insulation.
2. Splices in extension and drop cords.
3. Poor wiring such as wire too small to carry the current; wiring that is open and not in a conduit; wiring that is put in for temporary use; wiring not located properly.
4. Parts of a machine or tool such as the housing and handle become energized due to short circuit or broken down insulation.
5. Conductors at rear of switchboard are exposed and accessible.
6. Machine switches and controls poorly located.

Unsafe Acts:

1. Abusing electrical equipment and poor housekeeping.
2. Overloading circuit and using heavier fuses.

3. Working on energized circuits thought to be dead.

4. Replacing fuses by hand on energized circuits.

5. Working on low voltage circuits that are energized thinking that they are not dangerous.

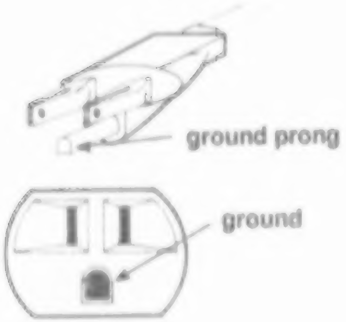
6. Using voltage much higher than necessary in places such as wet locations.

7. Removing the grounding prong from a plug to make it fit an outlet without a ground.

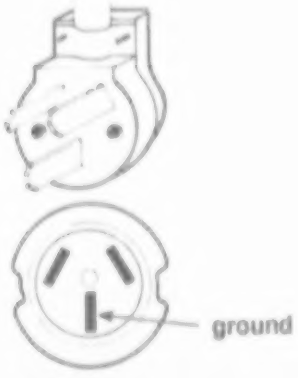
8. Failure to use safety equipment such as rubber gloves and mats.

9. Failure to use the ground fault circuit interrupter - a safety device that stops the flow of electricity instantly reducing the chance of a fatal shock.

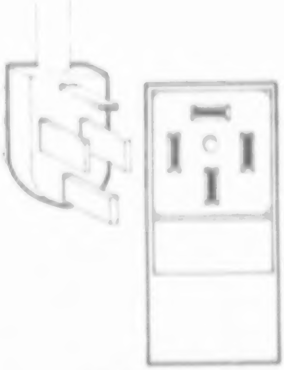
As we said earlier it would be impossible to list all hazardous conditions and acts concerning electricity. However, by following some common sense procedures and safety rules we can avoid many of them. One of the most important measures that should be taken is a regular schedule of inspection and preventive maintenance. All portable and stationary electric tools along with their wires should be cleaned and gone over for damage and wear. Extension cords that are perfectly safe when bought can become dangerous in a short time if they are not cared for properly. They should be cleaned of oil and water, and should be protected from any cutting edges or abrasive material. Extension cords should never be spliced. Also, extension cords should match the tool and the electric outlet. Under no circumstance should the prongs be cut off or bent to fit. If the power tool draws a lot of current, the wire in the cord should be heavy enough to carry it. Safety equipment should be used even if there is a remote chance of being shocked. And if there is any doubt in your mind about the safest procedure to use in any situation involving electricity, do not go any further. Get help from the instructor or your employer.



120 VOLT



240 VOLT



THREE PHASE

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:____________________________ **DATE:**____________________

UNIT:	Safety
TOPIC:	Electricity
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate an understanding of the safe use of electricity.
REFERENCE:	Student Information Sheet/Using Electricity Safely
DIRECTIONS:	Answer in your own words.

1. What effect does moisture have on an insulator?

2. Describe the part a car frame plays in an automotive electrical circuit.

3. Name the part of the human body that acts as an insulator.

4. How does the wire size effect current flow?

5. What is the main difference between the flow of water and the flow of electricity?

6. Why will the same amount of electricity kill some people but not others?

7. State why you think common house current of 110 volts kills so many people every year.

8. What does the human body become a part of in a case of electrocution?

9. One should never touch anything electrical while standing in water or even with wet clothing on. Why?

10 What is the main line of defense against electrocution?

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT:	Safety
TOPIC:	Emergency Treatment of the Accident Victim
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will be able to discuss proper emergency treatment of the accident victim.

In 1961 the Regular Session of the 57th Texas Legislature passed an act which became popularly known as the Texas Good Samaritan Law. In part it states:

"No person shall be liable in civil damages who administers emergency care in good faith at the scene of an emergency for acts performed during the emergency unless such acts are willfully or wantonly negligent;"

What this means in plain language is that if people help someone who has been hurt in an accident, they will not be held responsible for what happens (even if the person is injured further) unless they hurt them further on purpose or through gross negligence. That is, as long as they neither ask for nor accept any money for their services.

The reasoning behind this law is stated in Section 2.

"Sec. 2. The fact that present law could be constructed so as to cause one acting as a "Good Samaritan" to be held responsible for his efforts, thereby making certain persons reluctant to render aid to helpless persons in emergencies, creates an emergency and an imperative public necessity....."

In words more simply stated, the law was necessary to remove the fear of being held liable for civil damages if someone helped an accident victim and did something wrong making the injury worse. Up until this time people could be prosecuted if they did, even though in an emergency situation often it is very hard to think and act rationally.

What this all boils down to is that now we are protected by law in our efforts to assist an accident victim. And, since we are all in this thing together, life that is, we are obligated to do so. If that is the case, we should know what to do if an accident occurs in the shop, on the highway, or at home.

GENERAL INFORMATION:

WOUNDS

Probably the most common type of injury is a wound that breaks the skin or mucous membrane. There are four types: scrapes or abrasive wounds (sometimes called "burns"); wounds from sharp cutting edges called incised wounds; lacerated wounds with much damaged tissue due to being jagged and irregular; and puncture wounds such as those made by a nail or tack. All of these are subject to infection and bleeding. Deeper wounds may involve bone fractures and internal organs.

For minor wounds with little bleeding the big danger is from infection. We live literally surrounded by germs. The surface of everything we touch, the air we breathe, and even our skin itself is covered with germs. While it is true that most germs are harmless, many of them are not. The skin is an effective barrier for most of them until it is opened with a scrape or cut to let them in. They can then multiply as fast as every 20 minutes. Think about how many you would have in 24 hours by doubling the number every 20 minutes. The germs feed on and destroy the cells around them. The wound may turn red and swell and, if not taken care of, red streaks soon appear. Wounds on the palm of the hand, below the knees, on the face, and over the joints are especially dangerous. Also, deep puncture wounds are extremely dangerous because of tetanus - the germ responsible for a fatal illness called "lockjaw".

Even the smallest wound allows thousands of germs to enter the body. Not only does the object causing the damage carry germs into the wound, but germs are pushed in from the outer surface of the skin itself. A physician can provide the best information for treating wounds. However, if none is available and the wound is minor, first aid treatment is as follows.

FIRST AID:

1. Wash you hands thoroughly with soap and water.
2. Wash the wound with soap and running tap water if available, but if not boil the water first then allow to cool to room temperature. Scrub the wound with a sterile (germ free) dressing such as found in a first aid kit.
3. Place a dry, sterile dressing over the wound and bandage it in place so it will not slip.
4. Infection may appear in from 2 to 7 days or even longer. Tell the victim to see a doctor.

In a situation where the wound is bleeding severely the first aid treatment is very different. Infection is secondary in importance. The primary objective is to stop the bleeding as quickly as possible. If a major artery is cut a person can lose enough blood to cause death in less than a minute. In most cases bleeding can be controlled by applying pressure directly over the wound. In an extreme emergency this can be done with the hand alone. But a better procedure is placing sterile dressing on top of the wound and then pressing firmly until the body mechanism for clotting takes over. If blood soaks through the dressing do not remove it. Place more on top of it and increase the pressure.

If the bleeding wound is to an extremity (hand, leg, foot, etc.) it can be controlled very quickly by squeezing the main supplying blood vessel against the underlying bone. In the arm the artery is located on the under side of the upper arm. Pressure should be applied about half way between the armpit and elbow. The blood supply to the legs can be restricted by pressing the heel of the hand against a point a little below the groin on the front of the inner part of the thigh. This squeezes the femoral artery against the pelvic bone beneath it. These measures will not completely stop bleeding, but will slow it down until cloth for a direct pressure bandage can be obtained. If the wound is to a hand or foot, elevating it above the body helps somewhat.

Cases when a tourniquet is justified are extremely rare. If one stays on much over 2 hours the victim can go into shock when it is released. Also gangrene may set in and then the limb might have to be amputated.

BONES AND JOINTS

In general there are two kinds of bone fractures, simple and compound. A simple fracture is when the bone has been broken, but there is no open wound extending through the skin to the fracture. A fracture is called compound when something, usually the broken bone, has torn through the muscle and broken through the skin. This kind is much more serious, for the open wound is always contaminated and infection is certain unless treated properly.

Two other types of fractures we should mention here are comminuted and green stick fractures. Comminuted means the bone is broken into many small pieces. As people get old their bones become more brittle and easily broken, so this fracture is most often found in mature individuals. A green stick fracture on the other hand, is most often found in children and adolescents. The fracture can be compared to the break in a green stick that has been bent until it splinters but does not part. Since children's bones are not hard and bend rather easily (like a green stick) they very often have this type of bone fracture.

FIRST AID

An accident victim with even a suspected fracture will need x-rays and professional treatment as quickly as possible. However, there are some things you should remember to do and things you should not do while waiting for an ambulance.

1. The broken ends of the bones should be kept still.
2. Joints connecting the broken bone to adjacent ones should be kept still.
3. The patient should be treated for shock. (discussed later)
4. Never ask the victim to try to move a part to see if it is broken.
5. Never ask the victim to try to walk on a limb that might be broken.
6. Simple fractures, sprains, and dislocations (joints out of the socket) should have an ice bag placed over them to control pain and swelling.
7. Ice bags should be used on compound fractures only if the wound is protected from water.
8. If a bone is protruding through the skin never try to push it back in.

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9. Control bleeding by the methods discussed earlier (direct pressure, artery squeeze, etc.).

10. If severe bleeding has been checked and splints are to be applied place a loose tourniquet above the wound so bleeding can be stopped quickly if it starts again.

11. If absolutely necessary to move someone with a possible broken back use extreme caution. The whole body must be turned as a unit so that no part of the back is twisted.

12. If a head injury is suspected keep the person quiet and as undisturbed as possible. Never shake and jostle the victim. If unconscious, turn the head to the side so saliva can drain. Loosen clothing around neck. Give no stimulants of any kind.

SHOCK

Before discussing causes and first aid treatment of traumatic shock, perhaps we should define the term "shock". It is a word that has several meanings: shell shock, an old psychological term; insulin shock, a term used for a diabetic suffering an overdose of insulin; electric shock which is very different; and temporary shock or fainting. Traumatic shock is none of these. It is a condition most often associated with severe burns, wounds, and fractures. A direct cause is the failure of the blood to circulate to satisfy the brain's need for oxygen. The greater the blood loss, the greater the chance for the victim to go into shock. If left untreated or treated the wrong way, shock can cause death even though the injury itself may not be that serious.

There are times when it may be very difficult to tell that accident victims are going into a state of shock. This is especially true if the injury is internal and the bleeding is into a cavity inside the body. The victim may seem normal, alert, and responsive but suddenly collapse. However, in most cases the person will display one or more of these symptoms: moist, pale skin cooler than normal; physical weakness; sweat on the lips and forehead; nausea and/or vomiting; eyes that look vacant; abnormal breathing; or a fast, weak pulse or a pulse that cannot be detected.

FIRST AID

The treatment for shock is the same for both prevention of, and caring for someone in shock. Here are the steps:

1. Loosen clothing around neck.

2. If at all possible keep the patient lying down unless there are head or chest injuries or difficulty in breathing. If these are present the head and chest should be elevated on pillows.

3. For patients with severe injuries the feet and legs should be elevated 8 to 12 inches unless it causes more difficult breathing, a head injury is involved, or if it causes the victim more pain.

4. Keep the patient covered as much as is necessary to prevent loss of body heat. Usually, adding heat can do more damage than good. Unless the weather is extremely cold with

danger of freezing, do not use heating pads or hot water bottles. If they are necessary they should be only slightly above body temperature.

5. If medical care is available within 30 minutes give the victim no fluids. If no medical help is available mix 1/2 of a level teaspoon of salt and the same amount of baking soda with a quart of drinking water. Give the patient a half glass every 15 minutes if requested. If nausea or vomiting occurs stop giving fluids.

BURNS

Few things are as frightening to most people as the thought of being burned alive. Yet at the same time many take unnecessary risks of doing just that.

FIRST AID

The best procedure for aiding a burn victim is immediate transportation to a hospital. There they can get professional care, and the necessary facilities are available. However, if medical assistance is more than a few minute away, steps should be taken to prevent or treat shock, relieve pain, and prevent infection.

1. Shock should be treated, as much as possible, by the methods discussed earlier in this lesson. This will depend to a large extent on where the victim is burned. If more than 10 percent of the body is burned, shock is a serious hazard. It is most often the cause of death when burn victims die within the first few days.

2. Cover the burn with enough sterile dressing to completely exclude air. This relieves pain and further contamination. The dressings should be dry, for germs can go through wet ones. They should be at least four layers thick, and six is even better. If enough dressings are not available, cloth such as a bed sheet should be made as sterile as possible and used. Another layer of tightly woven material should then be applied to exclude air even further.

3. If the arm or hand is burned keep it elevated above the body. When the burn covers more than 20 percent of the body, or if the lower extremities are burned, transport the victim on a stretcher, cot, or door - NOT SITTING UP.

4. Give small amounts of water for thirst. If medical help is not available within 20 minutes, mix the salt- baking soda - water solution discussed earlier and give 1/2 glass every 15 minutes.

MISCELLANEOUS

Dislocations - Treat as a fracture, immobilize the part.

Sprains of joints - If fracture is possible, immobilize the part. Otherwise, elevate on pillow and apply ice bag or cold, wet towels.

Muscle strains - Rest, apply warm, wet towels.

Electric shock - Use long dry stick to rescue victim from circuit. Give artificial respiration if not breathing.

Gas poisoning - Remove victim from area. Give artificial respiration if not breathing or breathing too weakly.

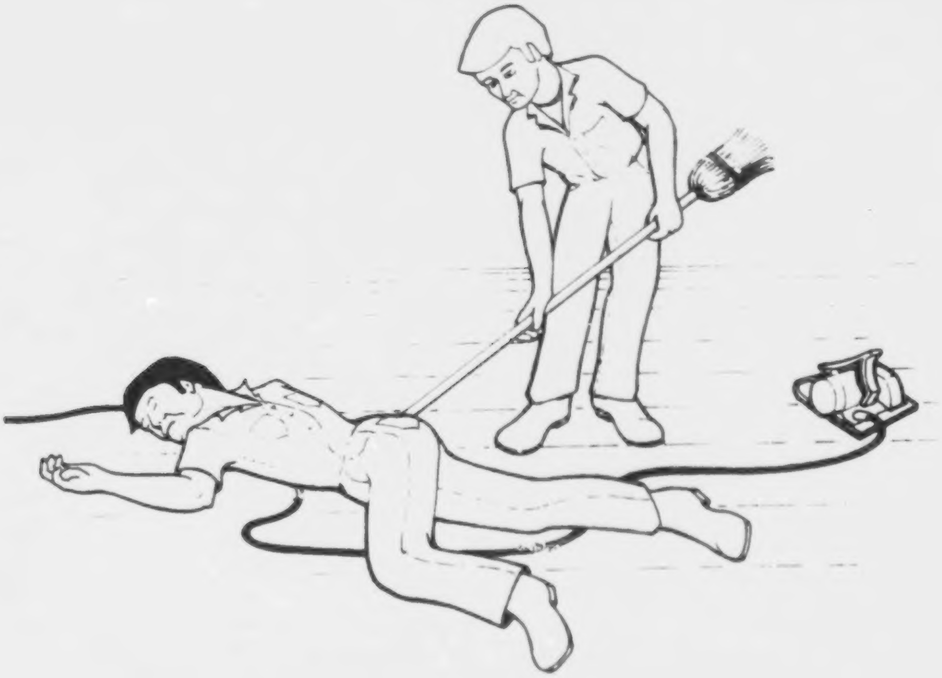
Hernia - Lay victim down to see if bulge goes back. If not, use cold, wet applications.

Chemical burn - Wash area with large amounts of water. Treat as for thermal burn.

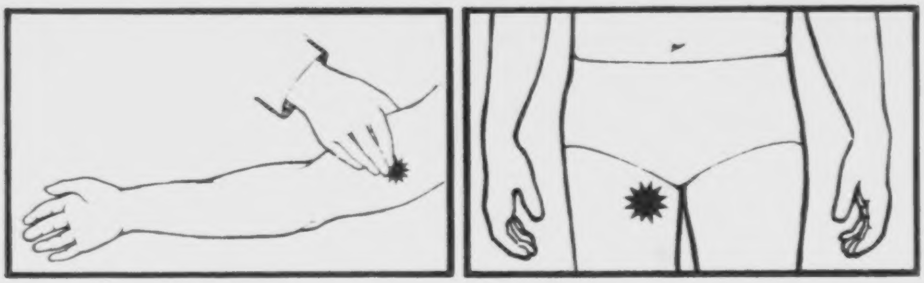
CONCLUSION

Information for this lesson came from First Aid Textbook, prepared by the American National Red Cross. The lesson is not a course in first aid treatment and was not intended to be. It was designed to give you the basics of what to do in case of an extreme emergency. Perhaps someday you may be able to save a human life - maybe even your own. Hopefully you will never get a chance to use this information. But just in case..........

USE DRY STICK OR TURN OFF THE CURRENT IF POSSIBLE

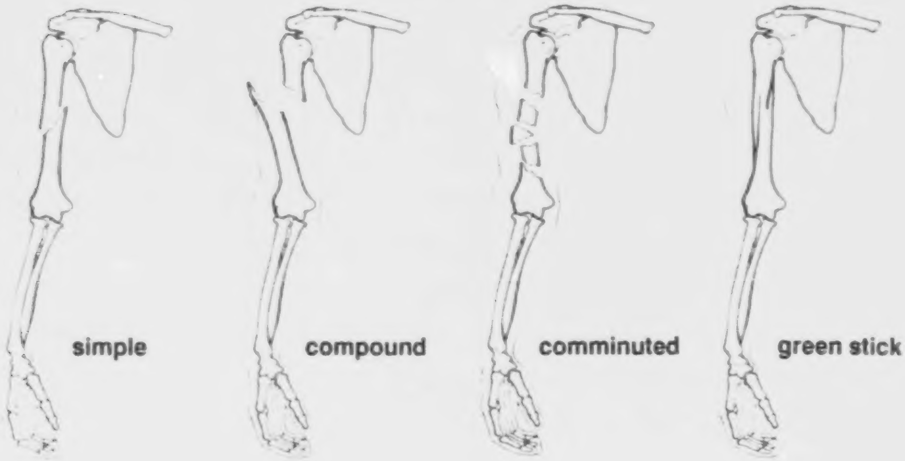


PRESSURE POINTS

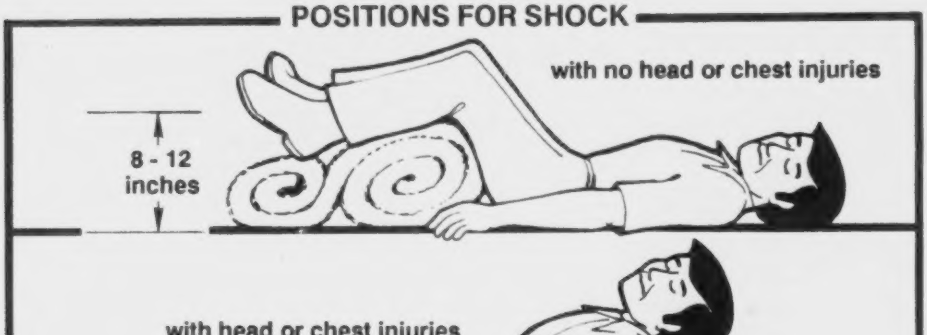


FRACTURES

FRACTURES


simple
compound
comminuted
green stick

POSITIONS FOR SHOCK


with no head or chest injuries
8 - 12
inches
with head or chest injuries

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**_______________________

UNIT: Safety

TOPIC: First Aid

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of first aid for accident victims.

REFERENCE: Student Information Sheet/Emergency Treatment of the Accident Victim

DIRECTIONS: Answer in your own words.

1. In a few words, what does the Texas Good Samaritan Law do?

2. Even a minor cut can be dangerous. Why?

3. A deep puncture wound that only bleeds a little can be deadly. Why?

4. What is the usual method of controlling bleeding quickly?

5. A bleeding wound on the chest is harder to control than one on the leg. Why?

6. Why is a tourniquet seldom justified?

7. Of the two kinds of bone fractures, which is more dangerous? Why?

8. Severe shock can cause death in a very short time. What actually cases death?

9. Why should water and air be excluded from a burn?

10. Why is it important to use a non-conductor to rescue an electric shock victim?

JOB SHEET

ELECTRICAL TRADES I

NAME:________________________________ **DATE:**______________________

UNIT: Safety

NAME OF JOB: Treating an Accident Victim

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to treat an accident victim.

TOOLS AND EQUIPMENT: Broom with wooden handle, first aid kit.

MATERIALS: Clean cloth, soap, water.

GENERAL INSTRUCTIONS: Use information provided in Student Information Sheet/Emergency Treatment of the Accident Victim. Decide what type of accident you will be treating.

PROCEDURES AND/OR TASKS:

1. Ask a member of the class to act as the accident victim.
2. Tell the class what type of accident you are treating.
3. Select the correct materials, equipment, etc. you will need to treat the victim.
4. Demonstrate to the class how treatment should be given.
5. Replace materials, equipment, etc.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Safety

TOPIC: Avoidable Conditions and Actions

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to discuss how unsafe conditions and actions may be avoided.

In this lesson we will learn that accidents are caused by two things - unsafe conditions and unsafe acts. We will also find how human error is a contributing factor in 95 percent of all cases.

There was a time, even here in our own society, that industrial accidents were accepted from a fatalist point of view. That means that most people thought accidents were something that just naturally went along with industry. If someone was seriously injured, they were paying the price for something mean they had done. If another person got killed on the job, it was simply "their time to go." Thousands of people were maimed for life or killed before anyone came along with the bright idea that accidents might be avoided. And sure enough, it was found that almost all industrial accidents were caused. And if they were caused, then they could certainly be avoided. The culprits were found to be unsafe conditions, unsafe actions, or combinations of both.

UNSAFE CONDITIONS

Since unsafe or hazardous conditions are the easiest to correct and control we will discuss that subject first. We cannot possibly cover every one possible, but we will touch upon those that are the most common causes of accidents. We will find that most of them are a matter of housekeeping.

Improper guards on machines - this hazard may be a result of several things: failure to adjust a guard to its proper working position; removal of the guard to make working easier or faster; using guards designed for older machines on newer models; failure of machine supply company to install or ship guards; poor guard design.

Broken or worn machine parts - machines do not have the ability to repair themselves as our bodies do. The moving parts eventually wear out. Getting "a few more miles" out of a machine has caused many serious accidents.

Sharp edged materials - most people would think of glass or sheet metal as the things with sharp edges. However, drill bit cuttings, wood, and even plastic can produce a serious wound if moving with enough speed and force.

Hazardous arrangements - setting up and arranging machines and equipment in a shop should be done by someone with experience and knowledge and who has safety as a primary objective.

Improper lighting - although workers usually have little to do with placement of permanent light fixtures in the shop they should always secure plenty of light for working by using drop lights, portable lamps, etc.

Improper ventilation - this is an especially hazardous condition when working with toxic chemicals and in areas where poisonous gases such as carbon monoxide are being produced. Even spray painting can be dangerous if the room is not well ventilated.

Unsafe clothing - some industries provide employees with work clothing for special jobs. If not kept in good repair it is dangerous, especially around machines with moving parts. This subject will be covered more completely in a later lesson.

Lack of personal protective equipment - if work requires special protective gear the shop should have it available. Not having it creates a hazardous condition.

Temporary hazards - when fellow workers leave objects in a walkway, stack objects that could easily fall, or in any of dozens of ways create a dangerous situation they have caused a hazardous condition.

Floors - due to poor original design, wear, or misuse, floors often create a hazardous condition. Also when a building is designed for one purpose, then later is used for an industrial shop, the floors sometimes do not match the needs of the trade and a hazard is created.

UNSAFE ACTIONS

Here we are dealing with actions of people, and since we are, we can easily see why it is much harder to do anything about them than correcting hazardous conditions. Once again we will present an incomplete list. But it is a list of the most common actions that have killed or maimed thousands of people for life - usually the individuals themselves, sometimes others, quite often both:

Operating a machine without authority and usually without any kind of training.

Failure to secure a machine so that it cannot be turned on when it has a malfunction and failure to warn others.

Working at a speed that the machine and/or the individual cannot handle.

Using equipment that is worn out or otherwise unsafe.

Working in a position or posture that is unsafe. In other words, taking a short-cut.

Wearing unsafe work clothing, wrong protective gear, jewelry (senior rings have caused the loss of many fingers), long hair.

Unsafe stacking, loading and unloading, securing, mixing, and placing.

Horseplay, the cardinal sin, causes accidents that are terribly hard to explain - especially to the innocent bystander who got hurt.

Lack of training and/or following a bad example causes many accidents to youngsters.

Youngsters often get hurt because they lack experience necessary to recognize the danger involved.

Actions of people with poor work habits are dangerous.

Acts performed by the shop clown ("Watch this."), the shop daredevil ("I'll try anything once."), and the shop coward ("You're just scared. I dare you.") have killed or hurt many good people.

Actions of people who are usually not even aware of failing eyesight, hearing, quickness, etc. are a hazard to themselves and others.

And finally, acts of people with a bad safety attitude make them the most dangerous ones in the shop. That will be the subject of Lesson Three.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:________________________________ **DATE:**________________________

UNIT: Safety

TOPIC: Causes of Industrial Accidents

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of causes of industrial accidents.

REFERENCE: Student Information Sheet/Avoidable Conditions and Actions.

DIRECTIONS: Answer in your own words.

1. Name the point of view that means accidents are bound to happen.

2. Name the two "culprits" of accident cause.

3. Which of the "culprits" is harder to control?

4. Which of the causes was described as the "cardinal sin"?

5. Who is the most dangerous person in the shop?

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Safety

TOPIC: Poor Safety Attitudes - Causes and Detection

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to discuss the relationship of attitudes and safety.

As the single largest cause of human caused accidents, bad safety attitudes cannot be over stressed. First we will discuss a few things that can contribute to their development, then we will learn how to quickly spot people in the shop who have that problem - the people we want to avoid like the plague.

GENERAL INFORMATION:

An attitude can be described as a set way of thinking about something. They can be either good (positive) attitudes or bad (negative) ones and are important in that they affect our behavior. We gain our attitudes mostly through experiences. But they are sometimes acquired "second hand", such as when we hear or read about experiences of other people. But the important thing is that attitudes are learned, and since they are, they can be changed and improved.

There are several personality types that can best be described as accidents looking for a place to happen. One of the most dangerous of these is the reckless gambler with an "it can't happen to me" attitude. This is the person who thinks taking risks makes work less boring and takes a chance even when doing a job safely would be easier. Very often they use their own lives as well as the lives and well being of their co-workers as stakes in the game.

Next on the dangerous personality list is "indifferent attitude". People with this problem have something missing in their character. Whatever it is causes them to have a "don't give a darn" attitude toward the safety of co-workers, and quite often toward their own. Removing machine guards, leaving oil or objects on the floor, and "forgetting" to warn others about a hazardous condition are some of their common traits.

Third on the dangerous attitude list is the "life of the party" type whose warped personality leads to playing practical jokes on co-workers. Setting up hazardous conditions to scare someone so that others can have a big laugh is a favorite joke. Better known as "horseplay", there is absolutely no place for it in a place of work.

Another cause of bad safety attitude is stubbornness. Some people seem to actually take pride in being "bull headed". They resent someone telling them how to do a job more safely, and as soon as the boss's back is turned, will go back to working the way they were before.

And then there are the people who completely lack emotional control. When something goes wrong or does not suit them they display a bad temper by having a tantrum. They sometimes take their frustrations out on people, but more often on tools and machines in the shop. They are dangerous when in this condition for anger causes a "so what", "don't care" attitude.

Early in this publication we said that our purpose was not to scare you, because fear itself is a cause of accidents. A frightened or nervous person is very often a chance taker. Worry about whether or not one is meeting the quota the company expects, about a meeting that is coming up, or even problems at home can cause a worker to have an unsafe attitude.

Very similar to the above is the person who gets paid by the piece-rate method. In other words, the amount of money they make depends on how many items they produce. People in this category often ignore safety because they feel it slows down their productivity. Accident rates in these factories usually are highest toward the end of the month when workers' rent, car payments, and other bills are coming due.

And finally, we have two personality types that we will lump together - the shortcutter who knows better but is just too lazy to do a job safely, and the "bad day" type who is too tired from the night before to go to the trouble.

So far we have listed a few personality types and the causes of their poor attitudes toward safety. We all know there are many, many other dangerous types that are apt to hurt themselves and others, so maybe we should learn to pick them out of the crowd, so to speak. We can do this very easily by watching their work habits.

Use of eye protection is one of the best things to watch for. A person with a good safety attitude will wear safety glasses even if the risk of injury is small. The opposite type will wear them only when the boss is around - even when the risk is great.

Head and feet protection is another easy tip-off. If hard hats and steel toed boots are the recommended safety gear, those with good safety attitudes will have them on when they come into the shop. The bad attitude types very often "forget" their hats and wear tennis shoes because safety boots hurt their feet.

There are literally hundreds of hazardous substances that can be absorbed directly through the skin. The best protection is wearing rubber or plastic gloves. Watch people mixing or handling chemicals. Those with high regard for safety will always have on proper hand protection. Others will not but will say, "this'll only take a minute." Hand protection is important in other kinds of work as well - handling or working with hot objects, removing broken glass, etc. The same rules apply - safe workers prepare themselves. Unsafe workers hurt themselves.

Wearing the proper kind of work clothing tells others a lot about workers' attitudes. Those who wear old worn street clothes to work seem to be saying they do not plan to stay long, that the work they do is not important, and that they are not concerned about safety. Loose, frayed clothing is especially hazardous around machines with moving parts.

Safety minded people are easy to spot when they are selecting or checking out tools and equipment to do a job. They want the exact tools needed, and they want to be sure they are in good safe working order. People with a poor safety attitude will improvise or "make do" in order to save a few steps or a little time.

In conclusion, you can recognize attitude by whether or not people comply to safety rules. Some workers do not seem to know that rules grew out of accidents in the past, and their purpose is to prevent new ones. Young industrial workers should develop good attitudes toward safety, and then stick to them. This is sometimes hard to do because older workers can influence youngsters on the job, and they often are one of the personality types we have talked about - the kind of person we need to avoid.

Whaaat?!*
Next time remember your parachute!

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Safety

TOPIC: Safety Attitudes

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of the relationship of attitudes and safety.

REFERENCE: Student Information Sheet/Poor Safety Attitude - Causes and Detection.

DIRECTIONS: Answer in your own words.

1. What is the single largest cause of accidents?

2. Attitudes are very important to us. Why?

3. How do we gain most of our attitudes?

4. Some people gamble by taking risks on the job. What are often the stakes in this game of chance?

5. People with something missing in their character, who do not care about the safety of co-workers, have what kind of attitude?

6. When is a piece-rate worker most likely to have an accident?

7. How can dangerous workers be spotted on the job?

8. What is the protection to wear when mixing chemicals?

9. What have safety rules grown out of?

10. What is the purpose of safety rules?

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Safety

TOPIC: Safe Work Clothing - Dressing for Personal Protection.

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to discuss proper safe work clothing.

A worker who had several years of experience at the plant was told to clean a pit under a machine. In order to protect himself from the oil and water that dripped from the machine, he wrapped a large cloth around his head, tied it under his chin, and let the loose ends hang over his shoulder. A short time later he was found in the pit decapitated. The cloth had been snagged by a revolving shaft that was about four feet above the bottom of the pit.

GENERAL INFORMATION:

The gruesome details of the case above show the importance of dressing to avoid accidents. There are a few simple rules that, if followed, will reduce hazards caused by what one wears on the job.

1. When buying work clothes, consider the hazards of the job and select those that lessen the danger.
2. Work clothes should fit well with no loose flaps or strings. Pockets should be small and few in number.
3. Clothing for shop work should be made of fabric that is comfortable, fire resistant, and durable.
4. Loose, torn, or ragged clothes, neckties, key chains, wrist watches, bracelets, and rings should not be worn when working in a shop.
5. Shirts with short sleeves should be worn when working with power tools or near machines with moving parts.
6. Pants should be long enough to cover the tops of shoes but not long enough to cause tripping. Cuffs should be avoided due to the tripping hazards, and also sparks and molten metal can cause a clothing fire if caught in a cuff.
7. Sharp or pointed objects, explosive materials, and flammable liquids should never be carried in pockets.

8. Good foot wear should provide both protection for the feet and the best possible slip resistant footing.

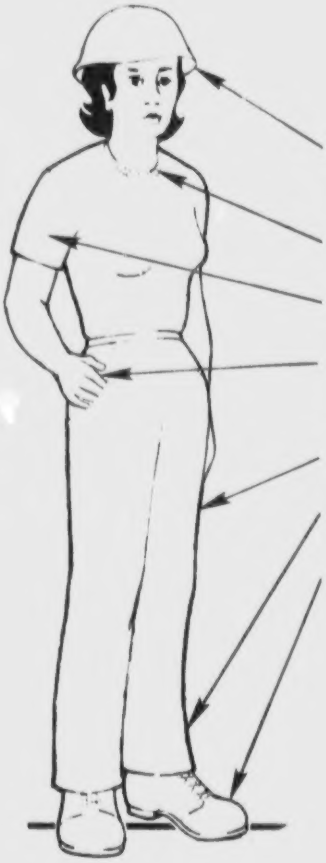
9. Head gear should be appropriate for the type work being done - heavy canvas caps for heat and spark protection while welding, hard hats in construction, etc. Long hair is hazardous in many work situations and should be either cut short or kept in a net.

10. Gloves should be worn when handling broken glass, rough lumber, sheet iron, hot objects, etc. They should be selected for the type work being done - plastic gloves when handling chemicals, rubber gloves in electrical work, etc. However, gloves should not be worn when working with power tools or near machines with moving parts. They can be snagged and the hand pulled into the machine.

11. Aprons are good protection from chemical splashes, when working with molten metals and in wet or oily situations. But, like gloves, they should never be worn when working near machines.

12. Keeping work clothes clean is especially important when working with solvents, caustics, toxic chemicals, etc. These not only can damage the skin, but may penetrate and go directly into the blood stream.

In any industrial shop there are dozens of things that contribute to causing an accident. Until machines learn to think and floors learn to keep themselves clean and dry we will never be able to eliminate all the hazards. But by simply dressing properly for our work we can control a great many of them.



Wear cap around power tools and machines
Hard hat in construction work

No tie

Short sleeves or buttoned tight at wrist

No jewelry of any kind - gloves when needed
but not around poser tools and machines

Snug fitting clothing

No cuffs

Shoes with strong soles - steel toes around
heavy materials

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Safety

TOPIC: Safe Work Clothing

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of the use of safe work clothing.

REFERENCE: Student Information Sheet/Safe Work Clothing - Dressing for Personal Protection.

DIRECTIONS: Answer in your own words.

1. What should be considered when buying work clothes?

2. Fabric for work clothing should have what properties?

3. What do rings, bracelets, neckties, and loose clothing have in common concerning an industrial shop?

4. Name the type shirt one should wear when using power tools.

5. What are two hazards mentioned in the lesson concerning pants with cuffs?

6. What are two important functions of foot wear?

7. When should gloves and aprons not be worn?

8. Why is wearing clean clothes especially important when working with toxic chemicals?

9. Where should sharp, pointed objects never be carried?

10. What should we do to help control job related hazards?

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Safety

NAME OF JOB: Safe Work Clothing

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will select and wear safe work clothing.

TOOLS AND EQUIPMENT: No tools or equipment are required.

MATERIALS: Listing of jobs for students to choose from.

GENERAL INSTRUCTIONS: Select the type of job you will be dressing for. Following information provided in class select proper work clothing. You may need a few days to complete your selection. Choose a class day to wear or bring the selected work clothing to class.

PROCEDURES AND/OR TASKS:

1. Select the type of job you will be dressing for.
2. Select the correct (safe) type of clothing you would wear to do this job.

   (You may ask your family or friends to allow you to borrow items needed.)
3. Wear the clothing to class.
4. Tell the class why you selected the type of clothing you did.
5. Demonstrate by acting out the job performance why the clothing is safe.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Safety

TOPIC: Eye and Ear Safety - Personal Protective Devices

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to discuss the importance of personal protective devices in relation to eye and ear safety.

It is a very sad but true fact that a great many industrial accidents are the result of not wearing personal protective gear. It is even more sad that, in some cases, the equipment that could have prevented the injury was close by. Eyes have been lost while the victim was carrying safety glasses in a shirt pocket. Brains have been scrambled while a hard hat was hanging in the poor soul's locker. This lesson is on protective gear for the two most important senses that we have - sight and learning. It also has a personal message for you - Wear it.

GENERAL INFORMATION:

EYES

Since the eyes are so sensitive and loss of sight is so terrible, perhaps we should talk about them first. The eyes of humans are a very complex piece of machinery. They do everything a movie camera does except record on film, and they do it automatically. One bad thing about them though - eyes are easily damaged and destroyed. And unlike the movie camera, spare parts are few and hard to find.

If you are the type of person who takes chances just because you have two eyes - a second one for a back-up, so to speak, talk to the young construction worker in Dallas, whom we will call Joe. He was getting ready to roof a new building and needed a straight line marked from one end of the roof to the other. Driving a nail in slightly at the starting point, he tied the chalk line to it. Walking to the opposite end of the roof he located the other point and drove in a nail where the cord was to be tied. In order to be straight the cord had to be very taut, and it was while pulling the line tight that the accident happened. The first nail came out and, propelled through the air as though from a slingshot, buried itself in the young man's right eye. Sight in the eye was lost immediately, but the doctors tried to save the eyeball by doing several operations over the next four months. It became infected and endangered the other eye, and finally had to be completely removed. So if you still feel it is all right to take chances because you have two good eyes, ask Joe about it. A freak accident? Maybe. But then most accidents are.

There are three types of protective devices for the eyes - safety glasses, goggles, and face shields. These are built in various styles and modified to protect against different hazards. Where the most danger is from flying objects such as in Joe's case, they are made with tough, tempered glass. For working with irritating chemicals, goggles without vent holes that completely seal the eyes from fumes and vapors are available. Where the danger is from radiation and heat, such as in welding, lenses that filter out harmful rays are used in goggles and shields. Even prescription ground safety glasses are available for people who normally wear glasses. These are often paid for by the employer in industries where eye hazards are great. There is a law that make employers provide workers with eye protection gear. But they cannot save an eye if left in the locker or in a shirt pocket.

EAR PROTECTION

Almost as important as the eye in helping us cope with our world, the ear is also a part of the body very often injured in industry. Unlike the eye, however, damage may take years to notice. The fact that people working in noisy occupations had a higher degree of hearing loss was known over a hundred years ago. Until very recently, though, very little was done about it. At present there are a large number of safety devices for protection from hearing loss. But before discussing them, let us learn a little about the properties of noise and how they damage the ear.

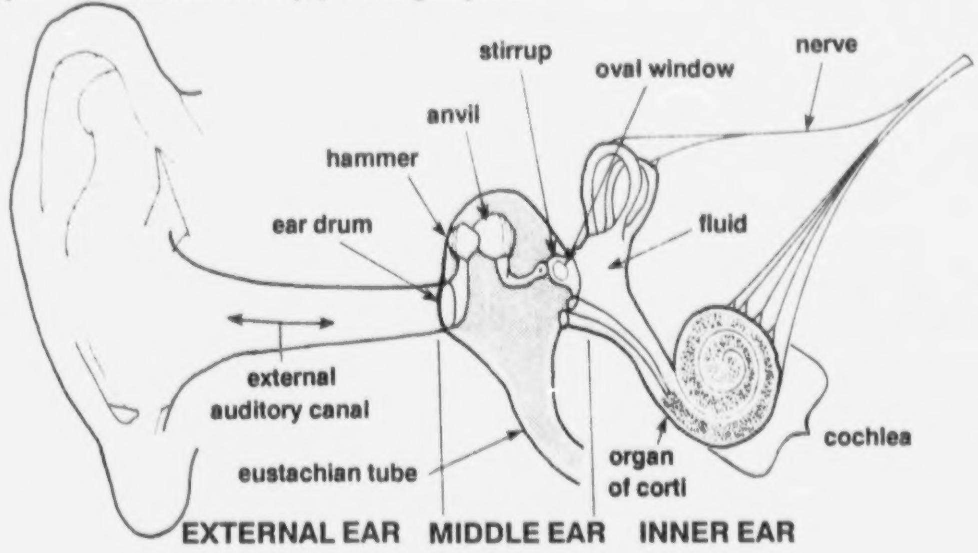
The three basic properties of sound that can impair hearing are: intensity or how loud it is, frequency or pitch, and duration or length of time one is exposed. Overall sound pressure levels are measured in decibels, and to give examples for comparison: a soft whisper at five feet is rated 30 decibels; normal speaking voice at three feet is 60 decibels; a very noisy restaurant 80; and the noise level of a rocket launch is 180 decibels.

The human ear can be divided into three sections: the external ear which captures and directs sound waves to the ear drum; the middle ear where three tiny bones in an air chamber connect the ear drum with the inner ear; and the inner ear consisting of a fluid filled, spiral tube and semicircular canals. Inside the spiral tube the walls are lined with cells that have delicate hairs extending out into the fluid. The hair cells are sensory in nature, and connect to a nerve which, in turn, connects directly to the brain. Sound waves make the ear drum vibrate causing motion in the chain of bones in the middle of the ear. This, in turn, causes fluid in the inner ear to vibrate. Motion of the fluid results in the hair cells being stimulated, and they fire messages through the nerve to the brain where they are interpreted as Beethoven or the latest rock group. Loss of hearing means either the inability to hear as well as a normal person, or it can mean the inability to hear as well as one once could. The loss can be either temporary or permanent. Listening to loud noises over long periods of time tends to over-stimulate the hair cells, causing them to "go dead" like a worn out battery. If not severely injured, they may return to normal after a rest period of a few hours, days, or even longer. If, however, the damage is severe enough, the hair cells stay dead, and permanent hearing loss results. Also, exposure to excessive noise can affect the human body in other ways - pain, nausea, and vomiting, and if severe enough, a reduction of muscle control.

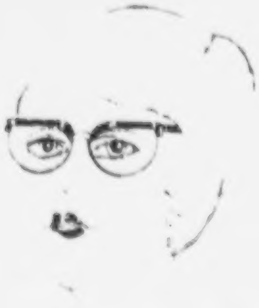
The most damaging noises to the inner ear are those of high frequency. But exposure over long periods of time and over a wide range of noise levels can also impair hearing. One of the first signs of hearing loss is the inability to hear high pitched sounds. If exposure continues, the impairment progresses to the lower frequencies of human speech and one becomes "hard of hearing". In industry the most common ear injury is "acoustic trauma" or destruction of the hair cells in the inner ear. The result is a slowly progressive loss of hearing of the same type as that found in people who are advanced in age. In fact, they are caused by the same thing - death of inner ear hair cells. The condition cannot be improved after the damage has been done, nor can it be avoided in advancing age. But in the case of industry it can be prevented - by being aware of the dangers, and taking steps to avoid them.

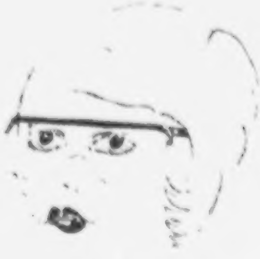
Ear damage can start when sound levels are below 90 decibels. Many shop machines are louder than this. Consider that the noise level of a woodworking shop is 110 decibels. The best way to correct a noise hazard is to muffle or do away with it at the source. But, since this is not always possible, here are some safety precautions that will put off deafness until you earn it with age. Never work on a noisy machine more than a few hours at a time. If the ears tingle or ring after turning off the machine, the noise level is dangerous. You should have on an caustic barrier of either the earplug or ear muff type. Commercial earplugs will reduce noise reaching the ear by about 30 decibels if they are fitted and used properly. A good brand of ear muffs will give a reduction of 10 to 15 more, and if plugs and muffs are used together, 3 to 5 more decibels are reduced. However, the noise level reduction cannot go over 50 decibels, because at this point the bones of the face and skull conduct sound.

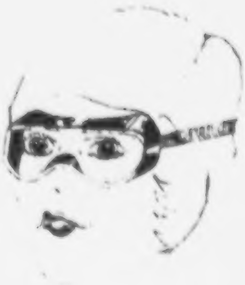
So now you know how to protect your two most precious senses - your sight and your hearing. And even though safety glasses may be uncomfortable and ear plugs a nuisance, being blind or deaf in a world designed for people who can see and hear would be even more so. Keep your safety gear with you at all times on the job. And if there is even a remote chance of an accident, wear it. When you celebrate your one hundredth birthday, you'll be glad you did.

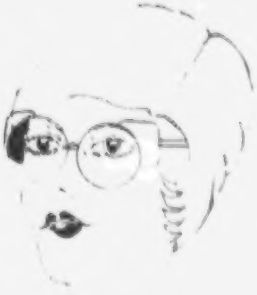


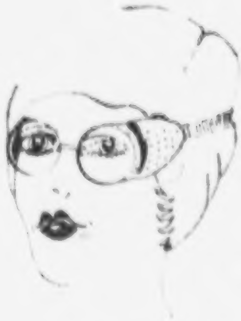
SAFETY EYEWEAR

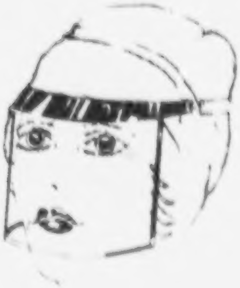

safety glasses

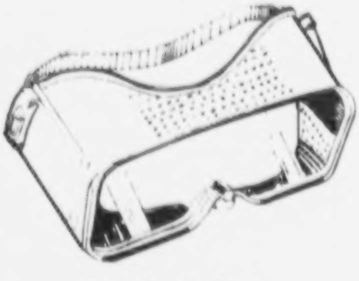

eyeshield

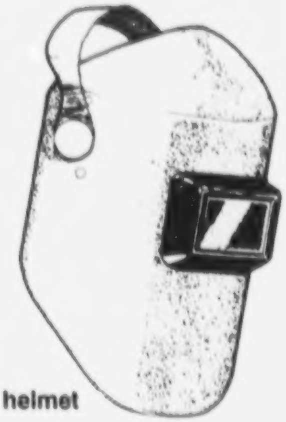

enclosed goggles


eyecup


welding goggles


face shield


vented goggles


welding helmet

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:__________________________________ **DATE:**________________________

UNIT: Safety

TOPIC: Eye and Ear Safety

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of the importance of personal protective devices in relation to eye and ear safety.

REFERENCE: Student Information Sheet/Eye and Ear Safety - Personal Protective Devices.

DIRECTIONS: Answer in your own words.

1. Name the machine the eye is compared to in the lesson.

2. Name the two most important senses that we have.

3. What are the three basic types of eye protectors?

4. Name three properties of sound that impair hearing.

5. How can severe excessive noise affect the body other than the ear?

6. What part of the inner ear "goes dead" causing hearing loss?

7. Which frequency sound waves are most damaging to the inner ear?

8. At what sound level can ear damage start?

9. What is the danger signal that you have been working where the sound level was too high?

10. Name two personal safety devices for avoiding ear injury.

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Safety

NAME OF JOB: Personal Protective Devices

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to select and wear personal protective equipment.

TOOLS AND EQUIPMENT: Display of personal protective equipment.

MATERIALS: List of task to be performed.

GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

1. Select a task to be performed.
2. Select the proper personal protective equipment to be worn.
3. Demonstrate how the equipment should be used.
4. Clean equipment if needed.
5. Replace the equipment.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT:	Safety
TOPIC:	Respiration Hazards - Lung and Skin Protection
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will be able to discuss respiration hazards and the importance of lung and skin protection.

Webster's Seventh New Collegiate Dictionary defines the word respiration as: "the placing of air or dissolved gases in intimate contact with the circulating medium of a multicellular organism (as by breathing)". Let us make this a little more simple and personal, and say it means breathing oxygen or other gases into the bloodstream of a human body. We usually think of the lungs when we talk about breathing, but there is another way dissolved gases and foreign substances can get into the bloodstream - through the largest organ of the human body - the skin. Therefore, when we consider the hazards and safety of respiration, we must think about both the internal and external organs involved.

GENERAL INFORMATION:

LUNG PROTECTION

For a complete discussion of lung safety we have two things to consider - exchange of gases inside the lung that can affect other organs of the body, and foreign substances that can damage the lung itself. The lung has two primary functions. It takes oxygen into the blood stream through the walls of tiny air sacks, and at the same time, it allows carbon dioxide to be released from the blood and exhaled. Under normal conditions these functions are carried out in perfect balance. Every cell of our bodies must have oxygen to use, and the waste product, carbon dioxide, must be removed. However, the lung cannot select out oxygen from all the other gases and fumes. And in our modern, industrial society, we often work under conditions that are far from ideal.

One of the biggest killers of all is carbon monoxide. This is a colorless, odorless gas that is produced when fuel is burned with a limited oxygen supply. An automobile engine is a good example of this. As stated earlier, the lung cannot pick out just the oxygen from the air and it allows carbon monoxide into the blood. When blood is loaded up with carbon monoxide it cannot carry oxygen the body must have, so cells begin to die. Human brain tissue can only live about 8 minutes without oxygen, and death is very fast. Running an engine in a closed shop or garage - even a leaky muffler that allows carbon monoxide inside a closed vehicle can be fatal.

Other work hazards that involve the lungs may not be as fast as carbon monoxide, but in the long run can be just as deadly. People who use asbestos in their trade, whether in construction, insulation, or even doing brake jobs, run a higher risk of lung cancer. Asbestos fibers have been proven to cause the disease. Iron oxide and nitrogen dioxide gases are produced in welding and can cause fluid to accumulate in the lungs. Glues and paint products can give off toxic vapors that, if breathed long enough, will damage the liver, kidneys, bone marrow, and the lungs. Even cleaning fluids such as carbon tetrachloride and petroleum solvents can cause headaches and damage liver, lung, and kidney tissue. Over a long period of exposure, common wood dust has been shown to cause damage to the sinuses and nasal cavity. As we can see from this, almost every industry has some kind of hazard that involves respiration. But just like most other hazards on the job, these too can be avoided by taking precautions and wearing safety gear.

The first line of defense is to get rid of as much of the air pollution from the shop as possible. Fans and exhaust systems should pull the air away from the individual. Vocational students have little or no control over the way a shop is ventilated, but they can usually work in a position that will reduce the amount of fumes and dust they have to breathe. If the air quality is dangerous, proper dust masks or respirators should be worn.

A dust mask that fits correctly is the second line of defense against dust and fibers from materials such as fiberglass used in insulation, and fibers from asbestos found in brake linings and some roofing materials. The masks are made of light, porous material and fit snugly over the nose and mouth. They are good for what they are designed for - filtering out particles in the air, but worthless as protection against solvent vapors, dangerous gases such as carbon monoxide, and air without enough oxygen. Using them under those conditions is the most common, dangerous abuse of respirators.

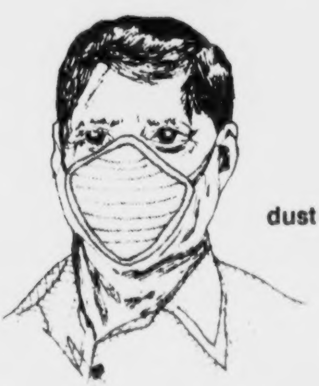
Another type of respirator has the particle filter like the dust mask, and also has a chemical cartridge for filtering vapors and fumes. The cartridge is filled with a highly absorbent material such as activated charcoal. Since chemical masks are designed to handle specific types of hazardous conditions, they must be chosen according to the situation. Some are for paint spray and solvents, others for mercury, and still others for ammonia. The cartridge has to be changed out after a certain amount of use since the chemical can only absorb up to a certain amount. Check the manufacturer's directions for this. And remember, these respirators are like filter masks - good for what they are designed for but no more. They will not filter out carbon monoxide, nor will they produce oxygen when there is none in the air.

SKIN PROTECTION

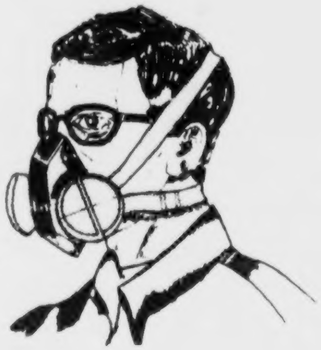
As stated earlier in the lesson, the skin is a large, highly specialized organ of the human body. Besides holding in and protecting the fluids, muscles, bones, etc., the skin also does a lot of "breathing" on its own. Our concern is not with carbon monoxide and oxygen here though. Instead we are concerned with substances that can irritate, burn, or even penetrate the skin and go directly into the bloodstream. In industry these substances may be caustics, toxic chemicals, or cleaning solutions.

The rate that substances can be absorbed through the skin varies on different parts of the body. The skin of the forearm is least with an absorption rate of 1.0, palm of the hand 1.3, bottom of foot 1.6, stomach 2.1, scalp 3.7, forehead 4.2, ear canal 5.4, and the lower groin or scrotum, a very high 11.8. In fact, penetration through the skin of the scrotum is so fast that it compares to injecting toxic poison into the bloodstream with a needle. At this rate it is more dangerous than drinking a cup of it. The condition becomes more serious the larger the area covered and the longer the toxic substance stays on the skin. Also the danger is not always just from the chemical itself. Substances such as pesticides often are in oil based materials that can also penetrate the skin. When the oil crosses the barrier, the final result can be death.

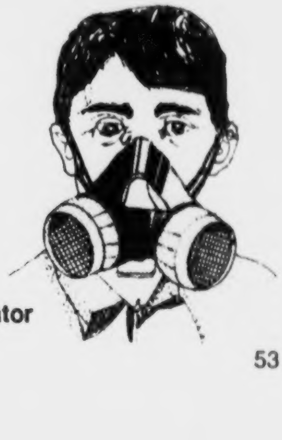
There are several things to remember when working with hazardous chemicals. First, the best protection is awareness of the dangers involved and the proper handling of materials. The label on the container will provide this information. Protective clothing such as rubber gloves and aprons should be worn when needed, and clothing that is contaminated should be thoroughly washed. Avoid splashing by filling a mixing container only half full. Clean up any spills promptly, then wash down the area. Never store unused chemicals in an unmarked container. By sticking to these simple rules and using good common sense, industrial workers can avoid most chemical related accidents. They need not become a part of someone's grim statistics.



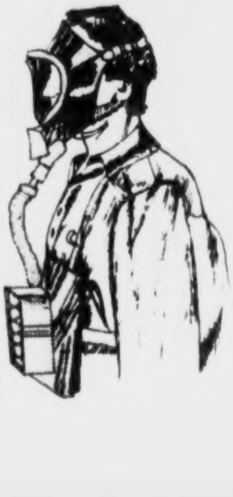
dust respirator



filter respirator



chemical cartridge respirator



gas mask

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:____________________________ **DATE:**____________________

UNIT: Safety

TOPIC: Respiration Hazards

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of respiration hazards.

REFERENCE: Student Information Sheet/Respiration Hazards - Lung and Skin Protection.

DIRECTIONS: Answer in your own words.

1. Name the internal and external organs of respiration.

2. What are the primary functions of the lungs?

3. What is produced if fuel is burned with limited oxygen?

4. How long can brain cells live without oxygen?

5. Asbestos fibers have been shown to cause what disease?

6. Dust masks are designed to protect against what hazard?

7. Why does the chemical cartridge in a respirator need to be changed?

8. What area of skin has the fastest absorption rate?

9. Pesticides may be termed a double hazard. Why?

10. What is the best protection against chemical related accidents?

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT:	Safety
TOPIC:	Material Handling
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will be able to discuss safety precautions which should be taken when handling material.

Moving and handling materials is an operation that goes on in every vocational class. It is an act common to every industry, and to almost everyone who works in industry. It also accounts for about 25 percent of all on-the-job accidents. Fractures, bruises, sprains, and strains are the most common. And, for the most part, they are caused by unsafe work habits - injuries brought about by the workers themselves.

GENERAL INFORMATION:

The types of physical damage mentioned above are usually caused by actions such as improper lifting, trying to carry a load that is too heavy, gripping an object the wrong way, not having enough clearance for the hands or feet, and not wearing the proper protective equipment. Let us talk about the art of lifting first. But before we do, here are some general pointers for anyone who handles materials:

1. Inspect the materials for anything that can rip, snag, or pierce the skin. Also look for rough or slippery surfaces.
2. Clean any greasy, wet, dirty or slippery objects before handling them.
3. Clean the hands of oil and grease.
4. Keep hands and fingers away from the ends of long objects such as lumber or pipe. This prevents getting them pinched if they strike another object.
5. Grip the object firmly.
6. Watch for pinch points when putting materials down.
7. Wear gloves when needed, but be careful with them when working around moving machinery.
8. Remove any rings, watches, bracelets and any other jewelry before handling materials. (It is a good idea to never wear these to work as we shall see later.)

9. Inspect the ground over which the material is to be carried.

10. If two of more people are doing the carrying, the procedure should be discussed so that everyone understands, especially how and when the object is to be put down.

Earlier we said that lifting was an art. If you find that hard to believe, ask any experienced weight lifter. Also ask why they use resin on their hands and feet when lifting very heavy weights. If the weight shifts in their hands or their feet slip and they lose their balance the weight lifter can be hurt very badly - torn muscles and tendons, broken bones, even damaged internal organs. But careless workers or those who do not know how to lift can be hurt just as badly. They need not be lifting a very heavy load either. There are more people around with bad backs because they moved an object weighing ten pounds or less the wrong way than all the others combined. These accidents most often happen when lifting off the ground, pulling or pushing, putting down, or when reaching too far. And the part that is most often hurt is the lower part of the back.

The backbone is a strong flexible pillar that has several functions. It supports the head and upper body, provides for attachment of muscles, and protects the spinal cord and spinal nerves. Between each bony segment (vertebra) there is a tough pad or cartilage called a disk. The disks act as cushions and as shock absorbers. Very strong ligaments hold the individual parts together, and since they can stretch a little, provide for the flex and rotation movements of the spine. Actual movement is accomplished by contractions of the many muscles that attach to the bony projections of the spine. They bony projections form a flexible chain of rings that covers and protects the spinal cord with its 31 pairs of nerves.

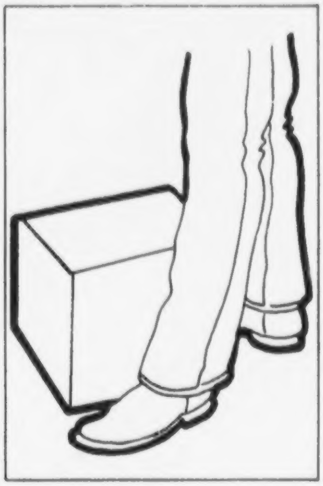
Now that we have had our biology lesson, let us see what it means to us as individuals. Have you ever heard the phrases; slipped disk, crushed disk, pinched nerve, pulled muscle? These are the terms most often used to describe a back injury. Why? Simply because they are the most common ailments caused by industrial accidents. The back is a very strong, versatile, complex part of our bodies' mechanical system. It is designed to, if used properly, provide a lifetime of useful service. If it is not, however, and even if only slightly injured through abuse, the pain and misery can last for years. Here is something else to think about. Compared to their number, very few back injuries are operated on to be corrected. This is because of the complexity and dangers involved. And even though the back can sometimes "heal" itself and stop hurting, it is seldom as good as new. People with bad backs must be constantly aware of activities that might re-injure them. This can range from missing out on the fun games at the picnic, to leaving a chosen vocation to find work that is lighter.

Another very serious type of injury that can happen when lifting or moving materials the wrong way is a hernia. This is a tear in the very thin sheet of muscles that surrounds and supports the lower intestines or guts. When a heavy load is picked up or the body is under a heavy strain, tremendous compression is put on the stomach. This pushes the intestines against the muscular sheet with a great amount of pressure, and can cause it to rupture or tear apart. In many cases, immediate surgery is required to replace the gut and to sew up the torn muscle. In some instances a plastic screen must be sewn into the sheet to give extra support. Even mild hernias can be dangerous if left untreated. Part of the intestine can fall through the tear and become pinched, cutting off its blood supply. Gangrene sets in after a short time resulting in death if not treated immediately.

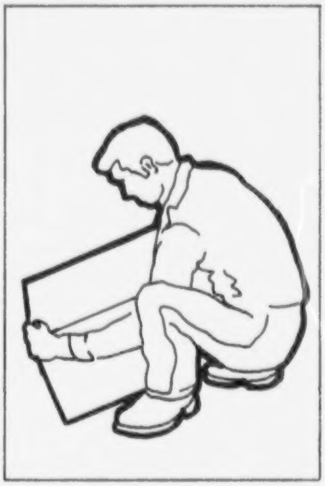
There are a few simple rules in lifting that, if followed, will minimize the chance of back injury and rupture.

1. Never try to lift more weight than can be safely handled by one person. Use mechanical devices when possible.
2. Bulky items are also dangerous because of the awkward position required to lift and carry them. Get help.
3. Position the feet correctly - one foot alongside the object and the other behind it. Feet should be a comfortable distance apart.
4. Bend the knees and squat close to the object keeping the back as straight as possible. This does not mean straight up and down necessarily, but means without bowing or curving the spine too much.
5. Grip the object firmly using the palms of the hands. If gripping devices are available, use them
6. Tuck the chin in toward the chest. This helps keep the spine straight.
7. Pull the object toward the body with arms and shoulders and lift with the powerful leg muscles.
8. If necessary to turn, use the feet. Do not twist at the waist for this can damage the spine.
9. Watch where you are going and walk slowly. Never run or take long steps.
10. When putting down the load, bend the knees, keeping the back as straight as possible. Use arm and shoulder muscles to lower the load.
11. Take care not to mash fingers or toes.

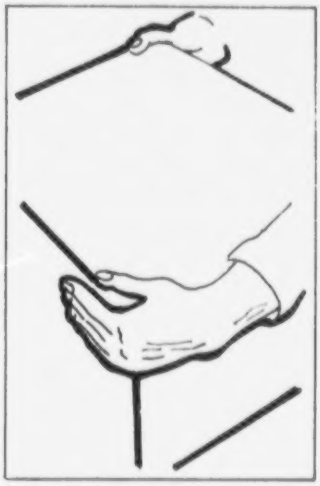
There is an old saying that goes "use you head and save your back." In any vocational shop this is a good rule to live by. Out in the industrial working world one out of every five injuries is to the back. Their cost in dollars is great. But this is nothing compared to the lives of misery and limited activity they cause the individuals.



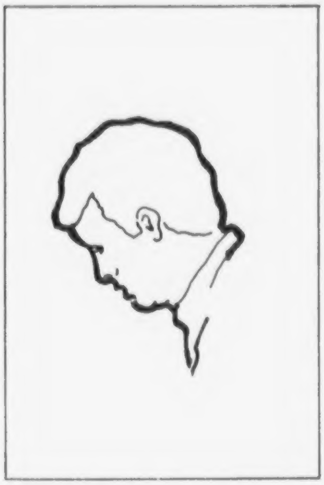
Position Feet



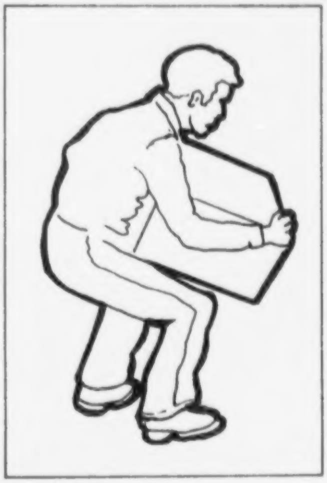
Squat With Back Straight



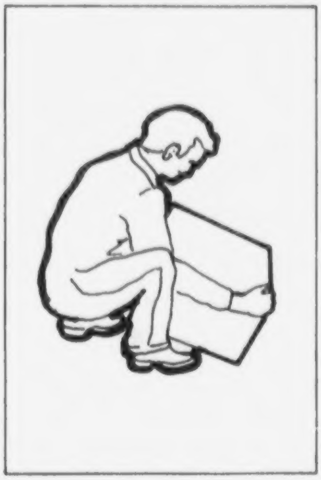
Grip Firmly



Tuck In Chin



Hug Object
Lift With Legs



Lower With Arms
and Shoulders

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT:	Safety
TOPIC:	Accident Prevention
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate an understanding of how accidents may be prevented when handling materials.
REFERENCE:	Student Information Sheet/Material Handling.
DIRECTIONS:	Answer in your own words.

1. Of all accidents that happen on the job, what percent takes place when handling materials?

2. Who causes most of the injuries to workers who are hurt while handling material?

3. Most back injuries are caused by lifting how much weight?

4. What area of the back is injured most often?

5. Name the part of the spine that cushions and absorbs shocks.

6. What are two functions of the bony projections of the spine?

7. Compared to their number, how many back injuries are corrected by surgery?

8. What is another name for hernia?

9. If the blood supply to a gut is cut off and gangrene sets in, what can happen to the individual?

10. What do you save when you use your head?

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Safety

NAME OF JOB: Lifting Correctly

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will lift an object using correct lifting procedures.

TOOLS AND EQUIPMENT: No tools or equipment required.

MATERIALS: Empty cardboard box.

GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

1. Check the weight of the load.
2. Lift with your legs and not your back.
3. Keep your feet close to the object being lifted, with one foot slightly closer than the other for better balance.
4. Stand with your feet approximately 8 to 10 inches apart.
5. Assume the squatting position with your back erect and then raise the object by straightening you legs.

   (**NOTE**: This method will bring the leg muscles into use and take the strain off the back.)

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT:	Safety
TOPIC:	Safe Use and Care of Hand Tools
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will be able to discuss the safe use and care of hand tools.

The history of making and using tools goes back many thousands of years. The first tool was probably a stick or a rock held in the hand and used for clubbing game or grinding seeds. Then some genius of that time discovered that a rock tied to the end of a stick was a very powerful weapon. Human beings had stumbled upon the principle of leverage. With the arm and stick acting as a lever, the rock could be propelled with a mighty crushing force. People no longer had to depend on only their own brute strength, for this new invention multiplied their power many times over. It was easier to keep the stew pot filled with his tool, so life was much better. And since humans are always trying to find better tools that will make their work easier, the next few thousand years produced four more principles; the axle and the wheel which can be thought of as "leverage in the round"; the inclined plane; the wedge; and last came the screw which can be thought of as an inclined plane wrapped around a shaft. These are the five basic principles that underlie all tools and machinery. Variation on, and combinations of these have given us the thousands of different tools and machines we have today.

GENERAL INFORMATION:

Since it would be impossible to discuss the safe use of every hand tool in every trade here, we will only talk about the most common ones. But before doing that, let us list some safety rules that should be followed in every trade:

Rule number one - be professional enough to get to know the tools of your trade, know how and why they work as they do, know how to use them, and know how to take care of them.

Rule number two - size up the job and select the right tools to do the work. Never pry with a file or screwdriver, and never use pliers on bolts when wrenches are needed.

Rule number three - use only tools that are in top condition. Injuries are often the result of using chisels with mushroomed heads, hammers with broken handles, and wrenches with worn teeth. Tools should be kept clean and free from grease and oil.

Rule number four - learn how to, and always use tools correctly. They are designed to do the best work if handled properly and can slip or break if they are not.

Rule number five - never leave tools lying around on the floor or work area. Keep them in a safe place such as a tool box, cabinet, or hang them on a wall. Tools on the floor can cause someone to trip and fall, and may be damaged themselves.

Rule number six - throwing tools to someone in order to save a few steps or a little time should not be done. It can be dangerous to the person and may also damage the tool.

Rule number seven - horseplay with shop tools is an absolute no-no. "Goosing" a person with an air hose can be fatal. Eyesight and teeth have been lost in "swordfights" and other such childish games.

Hammers

Just as the cave dwellers chipped stone into sizes and shapes for different purposes, modern industry has its tools for specific tasks. There are sledge hammers, ball peen, claw, tack, brass, and leather hammers.

Each of them serves a different purpose. One should use a claw hammer for carpentry work and machinist's hammer for machine work - big hammers for big jobs and small hammers for light work.

Always check out a hammer to see if the head is on tight and the handle is sound. Grasp it near the end of the handle and swing it smoothly. Be careful not to hit a metal surface harder than the hammer face.

Screwdrivers

Ever since the screwdriver and screw were invented, some people have seemed confused as to what they are and what they are not. Screwdrivers have been used as pry bars, wood chisels, bolt cutters, etc. And quite often, the unsafe use resulted in injury to the worker.

Select a screwdriver of the right design and size, and the job will go much easier. Neither the screw, screwdriver, nor you will be hurt.

Wrenches

A wrench should fit snugly and be big enough to do the job. Putting a piece of pipe over the end for more leverage should not be done. If using an adjustable wrench the pull should be toward the movable jaw. If it is absolutely necessary to push a wrench, do so with the palm of your open hand, and be careful to keep your balance. Never leave a wrench hanging on a nut, and also never apply a wrench to moving machinery.

Saws

In order for saws of any kind to do their best work they should be kept sharp and free of rust. When not is use they should be wiped clean and dry then hung up. Never force a saw, and one should

427

not work a saw too fast. This is especially true when using a hacksaw to cut metal. It heats up and ruins the blade and may cause it to break. Broken blades can cause severe cuts or punctures.

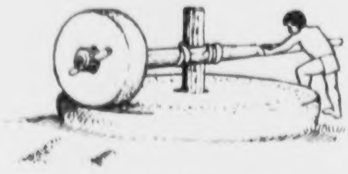
Files

If you look at a file closely you will note that it has a pointed end. This part is called a "tang" and is not a handle. It is for inserting into a handle which no file should be without. You will also note that the "teeth" of the file are pointed toward the end opposite the tang. This means they cut or shave metal when pushed in that direction only. Dragging a file backward over metal quickly wears down and dulls its teeth. Never pry or hammer with a file.

Punches and Chisels

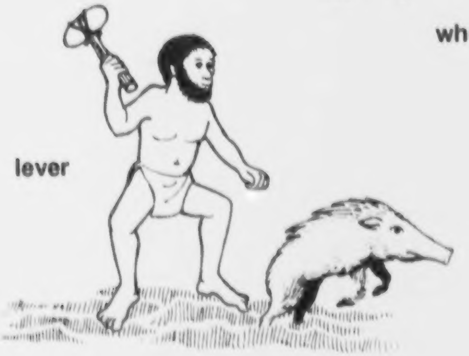
Protection for the face and eyes should always be worn when using a chisel or a punch. This is especially true when the heads of these tools are mushroomed. Fragments with sharp edges can fly off at tremendous speeds and penetrate an eyeball or even the flesh. Shields should be placed around the work area to protect others working nearby. The heads of chisels and punches should be periodically dressed and the cutting edge kept sharp so they will work with lighter hammer blows.

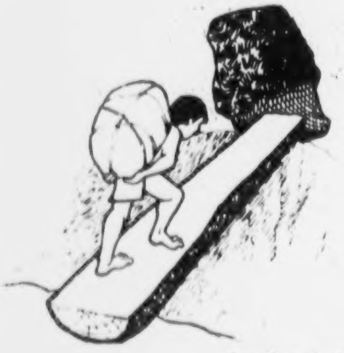
It has been stated that you cannot tell anything about workers' abilities by the amount of dirt and grease on their work clothes - but you can by looking in their tool boxes.



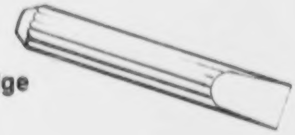
wheel and axle

lever

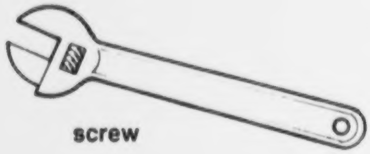




inclined plane



wedge



screw

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:________________________________ **DATE:**________________________

UNIT: Safety

TOPIC: Safe Use and Care of Hand Tools

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of the safe use and care of hand tools.

REFERENCE: Student Information Sheet/Safe Use and Care of Hand Tools.

DIRECTIONS: Answer in your own words.

1. Name the five principles upon which tools are based.

2. What is the most important rule regarding tools if you are a professional in your trade?

3. Name the principle that is "leverage in the round".

4. Why should one use only tools in good condition?

5. Why should one leave all childish behavior at home?

6. In what direction should one pull on an adjustable wrench?

7. If absolutely necessary to push a wrench, how should it be held?

8. Why should one not saw metal too fast?

9. In what direction are the teeth of a file pointed?

10. Describe a good clue to workers' abilities.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Safety

TOPIC: Shop Machines and the Industrial Color Code

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to discuss shop machines and the industrial color code.

In the last assignment we learned some important safety factors and rules concerning the use of simple hand tools. You learned that these could be lethal weapons if misused even though powered by the muscles of only one person. This is an important thing to remember when you graduate to using power tools and machines. Now you have become a director of power that is ten times, a hundred times, perhaps a thousand times greater than your own. Along with this greater power comes the added responsibility of learning to use it safely.

GENERAL INFORMATION:

As in the last assignment it would be impossible to go into the safety aspects of every power tool in industry. There are, however, some procedures and safety rules common to all of them.

PORTABLE POWER TOOLS

Portable power tools such as drills and saws should be inspected for damaged or broken parts. If the tool is powered by electricity, the cord and extension cord should be checked for frayed insulation and ground wire connection. Almost all electrically powered hand tools have a 3 - conductor cable, and as we learned in a previous lesson, the third wire is to ground the tool. This reduces the chance of accidental shock, but in order to work it must be properly plugged in. Along this same line, if the tool is hydraulic or if it operates on compressed air the lines and connections should be inspected for leaks.

Be sure to select the right tool for the job and equip it properly. Saws come in various sizes, and it is usually best to use a big one on big jobs and small ones on little jobs. They also have different types of blades - masonry blades for cutting bricks, blades for cutting iron, and blades for cutting wood. And, although it is sometimes tempting to save a little work or a few minutes by using the wrong blade, this can be extremely dangerous and damaging to the tool. Always use the proper attachments.

A power tool should never be returned to the toolbox or storeroom dirty. One that is covered with dust is a fire hazard, and dirt can clog up moving parts. This is especially dangerous if the moving part is a guard on the tool that is designed to protect the worker. Read the manual on how to clean the tool. With the power supply unplugged or turned off with no way it can be turned on without your knowing it, clean and lubricate the tool. It should then be checked for adjustment.

One of the most important aspects concerning using power tools safely is knowing how to use them. Watching an expert or an "old hand" skillfully use a tool can often lead an inexperienced worker to think it is easy to do. They might not know how to even check its guard adjustment, but feeling confident that, "since old so and so can do it, I can too", they pick up the tool and hit the switch. In some of these cases fingers have been stitched back on. In others they have not. When a portable power tool is used it should be held in a position that, even though the unexpected happens, the worker is not thrown off balance. The piece being worked on should also be firmly held in position with a vice or clamp - never with one hand or the feet. Almost all portable power tools have a release - stop switch that shuts off the power. However, many are equipped with a button that will lock the switch in "on" position. This should not be used unless absolutely necessary, and then only with the utmost caution.

POWER MACHINERY

The National Safety Council estimates that from 10 to 15 percent of all injuries on the job involve power - operated machines and equipment. They further estimate that power machines are involved in 19.2 percent of the injuries that leave workers partially disabled the rest of their lives. Of those who are killed on the job, 3.1 percent are involved in accidents with power machines.

The first line of defense in avoiding accidents with power machines is a competent, safety conscious worker. Just as in using power tools, a person should never try to use a machine without being shown how to operate it. A lot of people have been injured when they thought they understood a piece of equipment but did not.

When working around moving machinery there are some things that cannot be done safely. One should not make repairs or adjustments unless the machine is unplugged and completely stopped. Then the power cord should be rolled up so that someone cannot turn on the machine without your knowing it.

You second line of defense in using power machines safely are those features built into the machine to make it safe - switches that require both hands, release - stop switches, shields, machine guards, etc. These are designed to control or eliminate hazards to the operator. They should never be "fixed" or removed to make an operation faster or easier.

So to sum it up, the way to avoid becoming an accident statistic, workers must do their part - wear the proper safety gear, know the machine and the dangers involved, and allow the safety devices to do their jobs. Machines respect no one. We must respect them.

INDUSTRIAL COLOR CODING

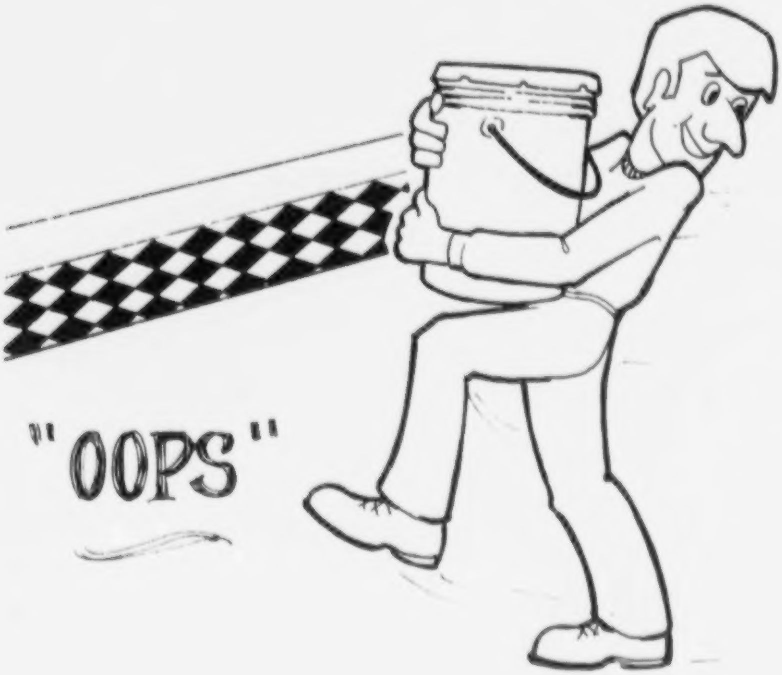
Experiments have been going on for decades which have proven that we humans respond to colors. Probably the most surprising thing about this is the similarity of our responses. Colors affect us emotionally through our visual senses. Cool, restful colors in the shop can reduce tension and cause us to feel more energetic. Others can cause the opposite reaction. Some people become so angry they "see red". This is a good example of how we relate to colors.

In recent years safety organizations, people in industry, and paint manufacturing companies have worked together to produce "safety" colors. These meet specifications set up by the American National Standards Institute and are used for color coding in industry. They are used to identify danger zones, first aid equipment, fire extinguishers and blankets, traffic lanes, exits, etc. Some authorities disagree on a standard color coding system, so there will be some differences between the coding of various industrial shops. However, young trainees should become familiar with the color coding system in their particular shop or work area, and should know exactly what the colors mean.

The color coding system below is generally accepted by industry and does not conflict with that of OSHA regulation 1910.144.

COLOR:	INDICATES:	USED ON:
Safety Red	Danger, stop controls, emergency stops	Machinery stops, fire equipment, acetylene hose, signs, etc.
Safety Orange	High hazard area, extreme danger	Inside switch boxes, machinery guards, exposed gears, etc.
Safety Yellow or safety yellow stripe around middle	Caution	Operator controlled adjusting devices, safety containers for flammable material
Safety Yellow with black stripes or black checkers	Caution - watch your step, watch your head	Low overhead beams, protruding objects, etc.
Safety Yellow stripes	Work area outline	Traffic lanes, stationary machine work area
Safety Blue	Needed information, caution	Out-of-order signs, control covers, switch boxes
Safety Green	First aid and safety equipment	First aid kits, fire blankets, etc.
Safety Yellow with black or magenta symbol	Dangerous radiation	Area with radiation hazard
Yellow Bands	Identifies pipe use	Natural gas or steam line
Blue Bands	Identifies pipe use	Compressed air line

Black Bands	Identifies pipe use	Vent line
Grey Bands	Identifies pipe use	Water line
Aluminum with black band around middle	Trash can for other than flammable material	Trash cans



ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Safety

TOPIC: Power Tools and the Industrial Color Code

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of power tools and the industrial color code.

REFERENCE: Student Information Sheet/Shop Machines and the Industrial Color Code.

DIRECTIONS: Answer in your own words.

1. Electric power tools almost always have a three cord conductor. Why?

2. Why should one always use the proper blade in a saw?

3. What effect can be caused by watching an expert use a tool?

4. When should one lock a power tool in the "on" position?

5. What are the two most important factors in using power tools safely?

6. Discuss the safe way to hold a piece being drilled.

7. When is it safest to work on a machine?

8. What are some sayings that are not in the lesson which tie colors to emotions?

9. It can be said that color is a language of its own. Explain this.

10. Your own shop may have a color code different from the one in the lesson. If so, list the colors and what they mean.

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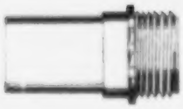
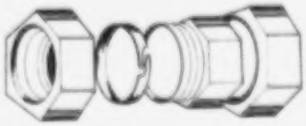
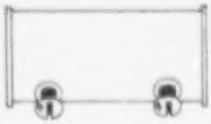


2. Compression type

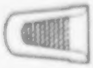


3. Coupler



B. Conductor connectors

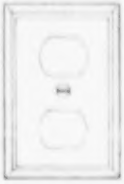
1. Wire nuts



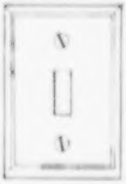
2. MN wire connector

VI. Types of Electrical Covers (Plastic or Metal) Used to safely cover switch and receptacle connections.

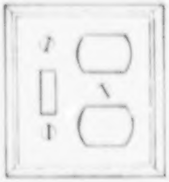
A. Duplex receptacle



B. Switch Cover



C. Combination duplex and switch



VII. Types of Switches--used to open and close circuits

A. Single pole

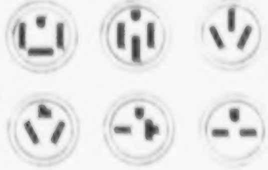
B. Three-way

VIII. Types of Outlets and Receptacles

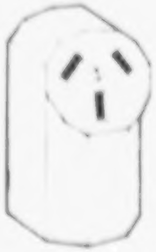
A. Duplex with ground

(NOTE: duplex without a ground is not approved for use.)

B. 208-240V



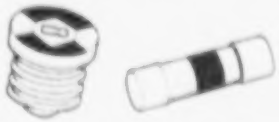
C. Surface mount 24V



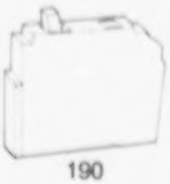
D. Weatherproof

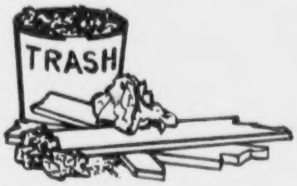
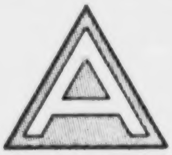
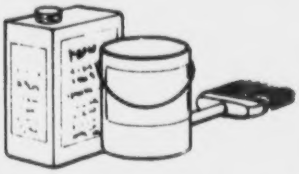
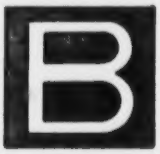
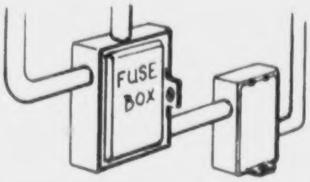
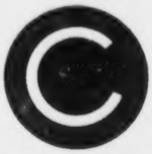
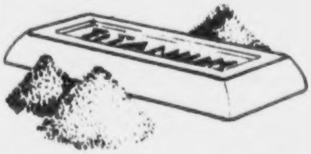
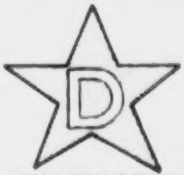
IX. Types of Electrical Safety Devices

A. Fuses



B. Circuit breaker



TYPE FIRE			EXTINGUISHER SYMBOL
CLASS A	**ORDINARY COMBUSTIBLES** WOOD ● PAPER CLOTH ● etc.		 GREEN TRIANGLE
CLASS B	**FLAMMABLE LIQUIDS** GASOLINE ● OIL PAINT ● etc.		 RED SQUARE
CLASS C	**ELECTRICAL EQUIPMENT**		 BLUE CIRCLE
CLASS D	**COMBUSTIBLE METALS**		 YELLOW STAR

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT:	Safety
TOPIC:	Fire Prevention and Control
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate an understanding of fire prevention and control.
REFERENCE:	Student Information Sheet/Fire Prevention and Control.
DIRECTIONS:	Answer in your own words.

1. What three things must be present to have fire?

2. How is fire compared to electricity in this lesson?

3. What is the best possible fire protection?

4. Of the three things necessary for a fire, which is most often used for prevention?

5. How are fire extinguishers classed?

6. Why should one never use a water hose on a type C fire?

7. How are fires classified?

8. What is the primary purpose of a fire blanket?

9. Who is responsible for fire prevention in the shop?

10. What type of fire requires special techniques and equipment?

UNIT III

INTRODUCTION TO ELECTRICAL TRADES

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Introduction to Electrician Trades

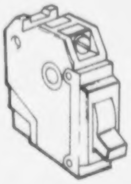
TOPIC: Terms and Definitions

UNIT OBJECTIVE: After completion of this unit, the student will be able to demonstrate an understanding of the basic concepts associated with electrical trades.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to define electrical terms.

When working in electrical trades it is important that you be familiar with the terminology used in the trade. Study each of the following terms and definitions carefully. Be prepared to discuss each term in class.

1. Alternating current (AC)--electrical current flowing one way at steady spaces in time
2. Ampere (AMP)--a unit for measuring the strength of an electric current
3. Circuit--the complete path of an electric current, such as from the power source through a lamp and back to the power source
4. Circuit breaker--a safety device which breaks the circuit by tripping a switch instead of burning out the wiring or appliance

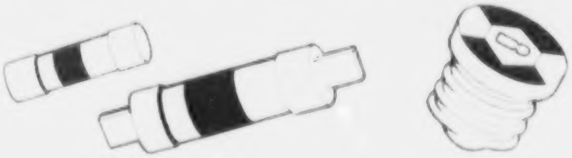


(NOTE: A circuit breaker can be reset after cooling.)

5. Conductors--materials through which electrical current flows

6. Current--the flow of electricity in a wire or other conductor
7. Direct current (DC)--electrical current flowing one way at a constant rate
8. Electricity--a kind of energy or power which can be changed into useful form
9. Electric meter--a device which measures the amount of electricity used

10. Fuse--a safety device which burns out when too much current flows through the circuit



11. Ground--a connection to the earth which serves as a return circuit

    (NOTE: Ground wires also prevent electrical shock.)

12. Horsepower (HP)--a unit of mechanical power which is the same as 746 watts of electrical power

13. Hot wires--the wire that carries the electrical current

14. Insulation--a cover over wires to keep electricity from escaping

15. Kilowatt (KW)--1000 watts

16. Kilowatt hour (KWH)--1000 watts used for one hour

17. Neutral wire--a wire that does not carry electrical current

18. Resistance (OHM)--electrical friction

19. Short circuit--a side circuit caused by faulty wiring so that the electric current is turned aside from the main circuit

20. Switch--a device used to open or close a circuit

21. Volt (V)--a unit for measuring the force of an electric current

22. Watt (W)--a unit for measuring electric power

23. Watt hour--one watt used for one hour

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________________ **DATE:**______________________________

UNIT: Introduction to Electrical Trades

TOPIC: Terms and Definitions

UNIT OBJECTIVE: After completion of this unit, the student will be able to demonstrate an understanding of the basic concepts associated with electrical trades.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will be able to define electrical terms.

REFERENCE: Student Information Sheet/Terms and Definitions

DIRECTIONS: Write a short definition for each of the following terms.

1. Alternating current--

2. Ampere--

3. Circuit--

4. Circuit breaker--

5. Conductors--

6. Current--

7. Direct current--

8. Electricity--

9. Electric meter--

10. Fuse--

11. Ground--

12. Horsepower--

13. Hot wires--

14. Insulation--

15. Kilowatt-

16. Kilowatt hour--

17. Neutral wire--

18. Resistance--

19. Short--

20. Switch--

21. Volt--

22. Watt--

23. Watt hour--

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Introduction to Electrician Trades

TOPIC: Occupational Outlook

UNIT OBJECTIVE: After completion of this unit, the student will be able to demonstrate an understanding of the basic concepts associated with electrical trades.

SPECIFIC OBJECTIVE(S): After completing this information sheet, the student will be able to discuss career opportunities available in the area of electrical trades.

Most residential electricians plan, install, and repair electrical circuits and components in existing buildings as well as those under construction.

Duties

When electricians are working on new structures their duties include the installation of power panel boxes, conduit, outlet boxes, and other concealed or recessed equipment before the interior walls and ceilings are completed. Electricians must be able to read blueprints, rough sketches, and follow verbal instructions in order to install electrical cables along walls, ceilings, and floors; mount outlet boxes for light fixtures, switches, outlets, heating and conditioning units, and machinery/appliances; secure panel boxes in position; and make circuit connections. After the walls, ceilings, and floors are in place, the electrician installs lighting fixtures, switch and outlet covers, and other electrical components.

Electricians who work on existing buildings must first locate the source of the problem (troubleshoot), repair or replace defective cables and/or electrical units, and check their operation. The work may involve tracing existing circuits, replacing or running new circuits and outlets, and changing panel boxes.

The work which electricians do is subject to approval by building inspectors. This means they must follow state and local building ordinances and the National Electrical Code. Electricians work with drills, electrical testers, pipe benders, and other tools.

Working Conditions

Residential electricians work both indoors and out-of-doors. Those who work out-of-doors are exposed to varying weather conditions. It may require working from beams, scaffolds, or ladders; performing repairs in poorly lighted areas such as cramped crawl spaces or attics. Hazards for this trade include falls from ladders and electrical shock. Injuries can be kept at a minimum however by observing safety precautions.

Training Requirements

An electrician must have good color perception, manual dexterity, and mechanical/electrical aptitude. Dependability, average intelligence, ability to follow oral and written directions, and the ability to get along with others is important.

It is recommended that electricians have completed a formal training program. It is possible however to learn the trade through informal on-the-job training. Wages are based on training, skill, and experience. Geographical location may make a difference in the amount the electrician will earn. Wages range from $8.00 to $20.00 per hour.

Outlook

The employment outlook for electricians depends on construction activity and will vary depending on the rise or fall in the construction industry.

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ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**____________________

UNIT: Introduction to Electrical Trades

TOPIC: Occupational Outlook

UNIT OBJECTIVE: After completion of this unit, the student will be able to demonstrate an understanding of the basic concepts associated with electrical trades.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet the student will answer questions regarding careers in the area of electrical trades.

REFERENCE: Student Information Sheet/Occupational Outlook

DIRECTIONS: Read each of the following statements. If the statement is true, circle the T. If the statement is false, circle the F.

T F 1. Residential electricians work only on new buildings.

T F 2. Electricians who work in the area of repair must first locate the source of the problem.

T F 3. Electricians are often required to work in crawl spaces or attics.

T F 4. Remodeling work may involve tracing existing circuits, replacing or running new circuits and outlets.

T F 5. Electricians work independently and do not require any type of approval on their work.

T F 6. A formal training program is recommended for electricians.

T F 7. All electricians will earn the same wage regardless of their training, skill, or experience.

T F 8. Wages for electricians range from $8.00 to $20.00 per hour.

T F 9. Electricians may learn through informal on-the-job training.

T F 10. The employment outlook for electricians depends on the activity in the area or construction.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Introduction to Electrician Trades

TOPIC: Related Careers

UNIT OBJECTIVE: After completion of this unit, the student will be able to demonstrate an understanding of the basic concepts associated with electrical trades.

SPECIFIC OBJECTIVE(S): After completing this information sheet, the student will be able to list and discuss career which are related to electrical trades.

When you first begin studying electrical trades you may think that the training you are receiving will prepare you for one field, residential electrical trades. However, there are numerous careers which are related to electrical trades.

Many of the skills you will learn can transfer to other career areas. How many businesses do you know which operate without the use of electricity? The connection may not be apparent the first time you look at a career. How effective do you think the police or firefighter would be without the use of communication equipment powered by electricity? Electrical power plays a part in protecting not only at the local community level. The effect can be seen on the national and international level in the area of the military services .

There are other careers you may not have thought about. You might be interested in working as a city electrical inspector. Electrical inspectors are responsible for making sure that city electrical codes are met. Electrical engineering technicians assist electrical engineers, scientists, and other specialists in converting ideas, theories, and principles into practical applications. Maintenance electricians are employeed by manufacturing industries, and commercial establishments. Maintenance electricians install, maintain, repair, and modify electrical motors, generators, wiring systems, transformers, and other electrical equipment.

Other related careers include: electric power plant worker, stationary engineer. electrical transmission line installer, cable splicer, instrument mechanic, electrical household applicance service technician, generator repairer, electronics technician, electrical engineer, telephone installer, and carpenter.

The uses of electrical knowledge are limitless and expand everyday.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:_______________________________ **DATE:**____________________

UNIT: Introduction to Electrical Trades

TOPIC: Related Careers

UNIT OBJECTIVE: After completion of this unit, the student will be able to demonstrate an understanding of the basic concepts associated with electrical trades.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet the student will answer questions regarding careers related to electrical trades.

REFERENCE: Student Information Sheet/Related Careers

DIRECTIONS: List two careers you feel you might be interested in. Give examples of how knowledge in the area of electrical trades could be used in that occupation.

UNIT IV

TOOLS, EQUIPMENT, AND MATERIALS FOR ELECTRICAL TRADES

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Pliers

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

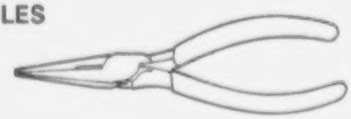
SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be familiar with the types of pliers used in electrical trades.

The tools discussed and illustrated in this unit are those used in house wiring jobs. The purpose of this unit is to help a technician select the proper tools, indicate safety measures in using these tools, their use, and maintenance.

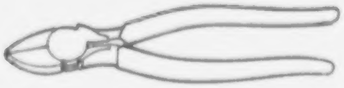
In order to perform a good job a technician must have good tools in good working order. But do not expect the tools to do the job, because the tool will do no better job than the user. Quality tools will last much longer and will consistently provide good results. Quality tools will cost more at the outset, but this will offset the repeated replacement of cheaper tools, mistakes, down time from breakage, and waste of materials.

A professional takes the job and personal tools seriously. Each type tool needed for the trade is purchased because this investment will pay off continuously in saving time and giving professional results.

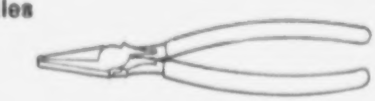
PLIERS HANDLES



curved handles



"handform" handles



extended handles

There are three basic types of handles for pliers as indicated in the preceding illustrations. Each type is designed for maximum comfort and efficiency.

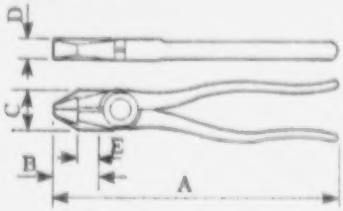
1. Curved handles on pliers are for greater control over the tool, such as cutting, bending, looping, and forming wire.

2. Handform handles are shaped to fit the hand; this gives the plier user a fuller grip and allows for more cutting power.

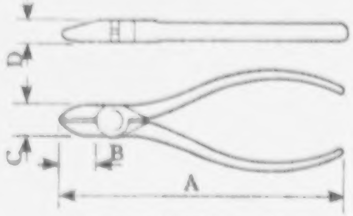
3. Extended handles provide for a longer reach of the plier and provide increased leverage.

Handles may be bare, dipped and coated with plastic, or insulated. Plastic coated handles are for comfort NOT for electrical shock protection. Even though handles are insulated this is only a secondary precaution against shock and should not be considered sufficient protection, and other safety measures must be exercised at all times.

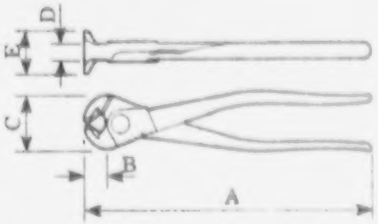
DIMENSIONING PLIERS



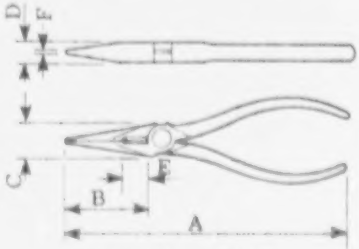
Side Cutting Plier



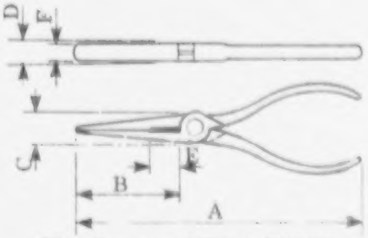
Diagonal Cutting Plier



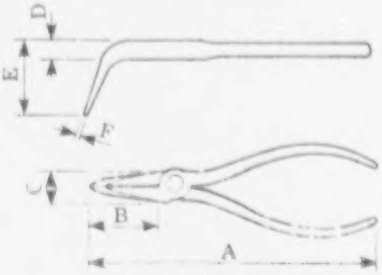
End Cutting Plier



Long Nose Plier



Flat Nose and Duck Bill Pliers



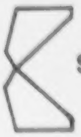
Curved Nose Plier

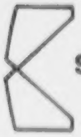
The letters as indicated on the drawings are keys to the dimensions of pliers. Only six types of pliers are illustrated with applied dimensions above. However, other pliers are dimensioned in a like manner.

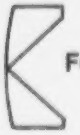
a. Overall Length
b. Jaw Length
c. Jaw Width
d. Jaw Thickness
e. Knife Length (Cutting Edges)
f. Point Thickness

These dimensions are most helpful to the technician when selecting pliers for the trade.

CUTTING KNIVES


Standard


Semi-flush


Full-flush

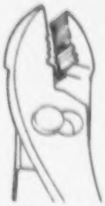
The preceding illustrations depict three types of knife edges for cutting pliers. Each type is designed to make a specific kind of cut in wire and for a certain general degree of wire hardness.

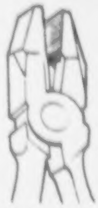
Standard cutting knives are used to cut hard wire.

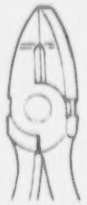
Semi-flush cutting knives are for close cutting wire of a medium hardness.

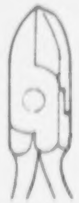
Full-flush cutting knives make a close, flat cut of soft wire only.

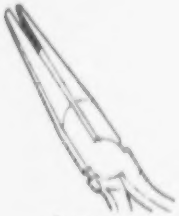
TYPICAL PLIERS USED FOR HOUSE WIRING

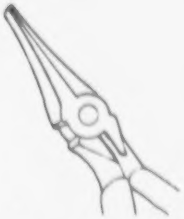

slip joint

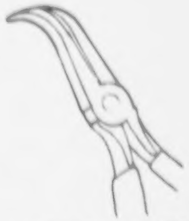

lineman

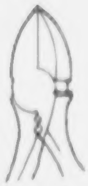

side cutting

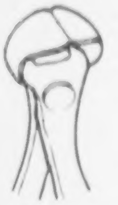

diagonal cutting

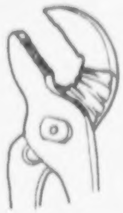

long nose


relay spring adjusting


curve-nose 70°


oblique cutting with skinning holes


high leverage end cutting


curved jaw

PLIER MAINTENANCE

The repairing of pliers is not recommended. Any plier which is cracked, broken, sprung, or having cutting knives that are nicked should be done away with and replaced with a new pair. Cutting knives are sharpened with a small medium-grade hone. Knurls inside plier nose (gripping surfaces) are cleaned with a wire brush. The plier hinge is oiled on occasion with a drop of oil; this helps preserve the tool and assures easy operation.

PLIER USE RULES

1. Pliers are not used in the place of another tool. They are NOT: hammers, pry bars, or wrenches. Using them for other than their specified job can damage: the pliers, the work, the user, as well as cause loss of time.

2. Pliers are not to be pushed beyond their intended capacity. They can be sprung or broken if too light a plier or the tip of a needle nose plier is used to attempt bending stiff wire. For this job use a strong blunt nose plier. Cheaters (handle extensions) are not to be used to extend the length of plier handles. If greater leverage is needed, select a plier that gives greater leverage.

3. Pliers are not to be exposed to excessive heat. Heat and direct flame will ruin a plier by drawing the metal temper. Cutting pliers are exceptionally vulnerable to excess heat and direct flame.

4. Hardened wire is not to be cut with ordinary pliers. Hardened wire is to be cut with that plier that is recommended for this job.

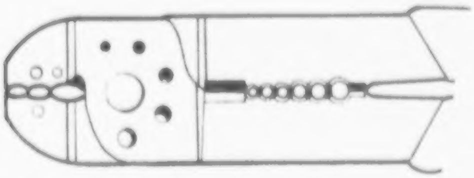
5. Pliers are not to be rocked from side to side to cut a wire, neither is the wire to be bent back and forth against the knives. This practice can spring, dull, or nick the cutting edges. Wire is to be cut at a right angle only. If a plier will not cut through a wire readily, the knives may be dull, or perhaps a plier of greater leverage is needed.

6. Wear goggles, safety glasses, or face shield for the task of cutting wire or any other metal. Be safe! Eye protection devices are an absolute must. It is easy to forget them -- It is a big bother to put them on -- especially for just one little cut. No excuse makes sense when eyes are at stake. Any reason or excuse for not wearing eye protection is the lazy person's way of doing things. The professional is always safe.

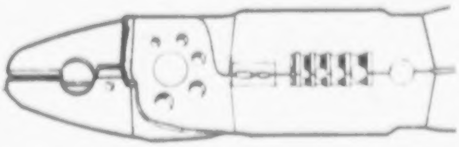
7. Before cutting metal or wire be sure co-workers are safe. Be considerate of their eyes and well being. Cooperation among workers is a must. The piece of wire or metal that did not get you may just get somebody else. So think about the other person as well as self.

8. Plastic-dipped handles are not insulation against electrical shock. This material on a handle is for comfort and a better grip on the tool. The plastic is not intended for protection against electricity.

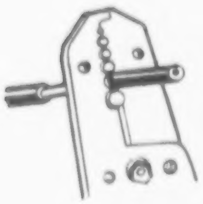
MULTIPURPOSE TOOL



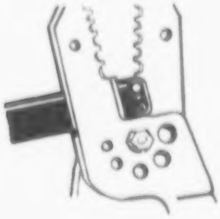
All-Purpose



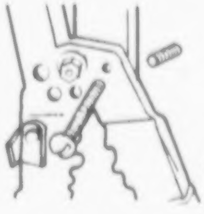
Super All-Purpose



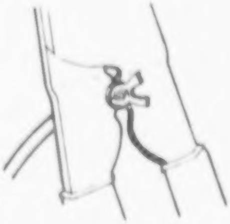
strip wire



cut wire



cut bolts



crimp

These tools vary in size and numbers of tasks they will perform. The all-purpose tool illustrated will shear bolts, cut wire, strip wire, measure stud sizes, gauge wire sizes, and crimp insulated terminals. The super all-purpose tool does the same tasks including crimping non-insulated terminals, crimps lugs, and crimps splices. Wire cutter in the nose will cut 10 to 22 AWG.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Pliers

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of the types of pliers used in electrical trades.

REFERENCE: Student Information Sheet/Learning About Pliers

DIRECTIONS: Below are questions that are to be answered in complete sentences and in as few words as possible. The assignment is designed to include correct spelling and use of the correct trade terms.

1. What are the advantages of selecting and buying quality tools?

2. Pliers are usually designed with three types of handles. What is each type handle designed for?

3. What are the type handles that pliers are equipped with?

4. Which type handle gives greater control over a plier?

5. What plier handles gives the user a fuller grip and allows for more cutting power?

6. What is the purpose of the plastic coating on a plier handle?

7. What are the dimensions to be considered when selecting a plier to purchase?

8. Plier cutting knives are manufactured in three general types. Which type should be selected to make a flush cut of soft wire?

9. What is the usual procedure if a plier needs major repair?

10. What is the usual procedure for plier maintenance?

11. What can be the results if a plier is used in the place of another tool?

12. What is meant by pushing pliers beyond their capacity?

13. What happens to pliers when they are exposed to excessive heat or direct flame?

14. If a plier will not cut through a wire readily, what are the usual causes?

15. What are the tasks that can be performed with multipurpose tools?

JOB SHEET

ELECTRICAL TRADES I

NAME: ______________________ **DATE:** ______________________

UNIT:	Tools, Equipment, and Materials for Electrical Trades
NAME OF JOB:	Learning About Pliers
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	In completing this job sheet, the student will demonstrate the ability to use pliers.
TOOLS AND EQUIPMENT:	Display of pliers prepared by instructor.
MATERIALS:	Used electrical boxes, switches, wire, etc.
GENERAL INSTRUCTIONS:	Follow instructions given in class.

PROCEDURES AND/OR TASKS:

1. Select one tool from the display.
2. Using proper safety procedures, demonstrate how the tool should be used.
3. Replace the tool.

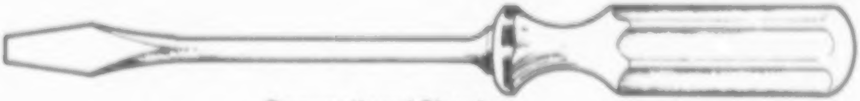
STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

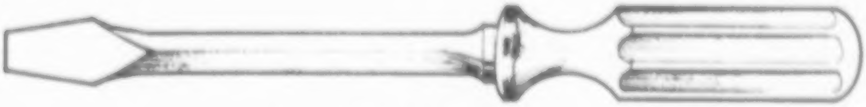
UNIT:	Tools, Equipment, and Materials for Electrical Trades
TOPIC:	Learning About Screwdrivers
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will be familiar with the types of screwdrivers used in electrical trades.

The two most used screwdrivers are the standard blade and the phillips head. These screwdrivers vary in length, shank diameter, and head or blade size. The tool ends are heat treated for necessary hardness and toughness to withstand the pressures put upon them.

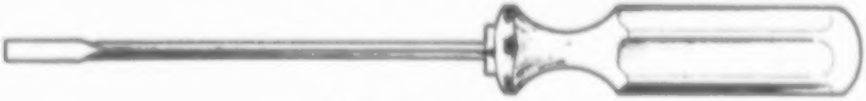
STANDARD BLADE SCREWDRIVER



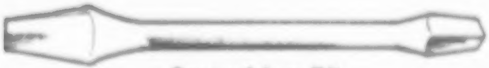
Conventional Shank



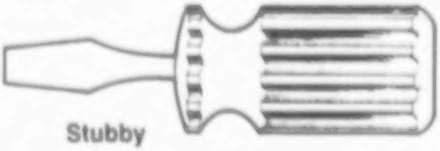
Heavy Duty Shank



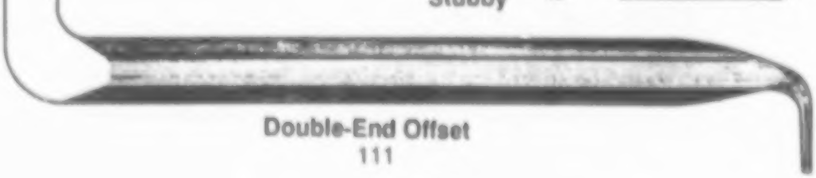
Electrician's



Screwdriver Bit



Stubby



Double-End Offset

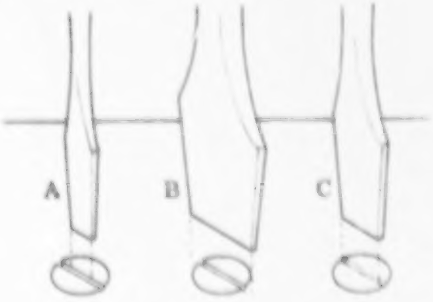
These screwdrivers have flattened wedge shaped ends which fit into the straight slot of a screw head. The conventional and heavy duty screwdrivers vary in length from approximately 3" to 12" with the shank diameter and the width and tip thickness proportional to the length. To measure a screwdriver length start at the blade tip and move up to the bottom of the handle.

For the usual screwdriver task the conventional shank screwdriver is used. The heavy duty screwdriver is equipped with a square shank. A wrench can be fitted to this shank to help drive or remove large or stubborn screws. Electrician's screwdrivers have long thin shanks with the blade width being approximately the same width as the shank diameter. Handles for electrician's screwdrivers are insulated. But again, this is secondary safety, not primary safety, or the only safety precaution to be taken. This is a useful tool for handling small screws.

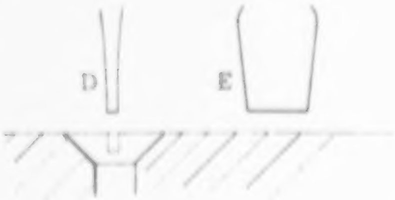
The offset screwdriver has two blades, one at either end of the tool. These blades are at a 90 degree angle to each other. It is designed for use in spaces where there is a lack of room for the conventional screwdriver. The stubby screwdriver (close quarter screwdriver) is a tool which has been designed for use in areas where there is limited work room.

SELECT STANDARD SCREWDRIVER FOR THE JOB

Screw Slot Length Compared To Blade Width



Screw Slot Width Compared To Blade Thickness



The correct blade must be selected for the screw to be driven or removed. As indicated in illustration A the blade tip is too narrow for the screw. Being too narrow, it is more than likely also too thin for the slot. The blade being too narrow tends to damage the screw head. If the blade tip is too thin, it will tend to twist and distort, making the screwdriver useless. Damaged screw heads are dangerous, as well as being difficult to drive or remove. Illustration B indicates the screwdriver as being too wide. This will have the tendency of damaging the work. Illustration C indicates the correct fit. Blade width is correct for screw slot length; also blade thickness is correct for screw slot width.

applied to the screwdriver.

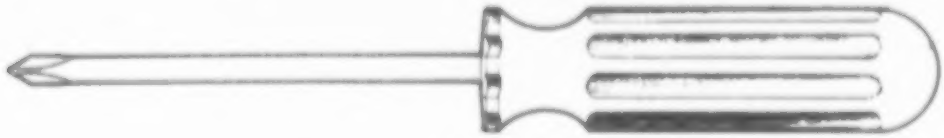
To drive or remove a screw, the screwdriver is held square with the screw and slot. The opposite hand is used to guide the blade into the slot and maintain proper alignment.

Worn blade tips must be reground. The grinding is done with a fine grinding wheel and very little pressure. Avoid overheating the tip. As the tip is ground, stop and check it for correct fit in a screw slot. Maintain the original taper and concavity. Blades are not to be ground to a knife edge or at too steep an angle. This will cause the blade to twist or climb out of the screw slot.

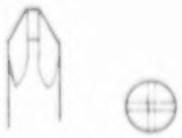
SAFETY

1. Goggles, safety glasses, or face shield must be worn when reshaping screwdriver blade.
2. Screws with burred heads are dangerous. Burrs will cut and scrape the skin. Screwdrivers slip causing other injuries. If the screwhead is not too badly damaged, it can be repaired by filing or sanding. Better, be safe and replace the screwdriver.
3. When working with electricity, use only insulated screwdrivers. Shut off current. When it is impossible to shut off the current, use a full length insulated screwdriver and keep hands free of any wires. When working away from an open switch, tag it. This is to keep someone from turning it on.
4. If it is necessary to hold a small unit in a hand, no downward pressure is applied to a screwdriver. The screwdriver can slip, which will cause the tool to pierce the hand.

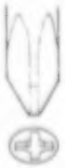
PHILLIPS SCREWDRIVER



Phillips



End



Screw Slot

Dimensioning of phillips screwdrivers is the same as the conventional screwdriver. Length: tip - to handle. Tip proportionate to shaft diameter. Use and maintenance are the same. The main difference is the X shaped tip.

CAUTION:

Screwdrivers are not substitutes for other tools.

1. They are not Chisels, Punches, or Drifs. Hammering on a handle can split it, rendering the tool useless. Tips can be damaged beyond repair.

   EXCEPTION: Screwdrivers with the steel shank extending through the handle may be tapped on with a hammer.

   If a screw slot is corroded or is full of rust, it is appropriate to gently tap on the handle while holding the screwdriver at an angle to clean the slot. After the screw head slot is clear, it is permissible to gently tap the screwdriver seating the tip firmly in the slot.

2. They are not pry bars. Tips are hardened to prevent rapid wear. The harder a tip the easier it will break. When a tip snaps, personal injury can accompany the ruining of a tool. The shank of a screwdriver will more than likely bend when the tool is used as a pry bar. Once the shank is bent it is very difficult to straighten and realign. A bent shank makes it very difficult to keep the screwdriver centered in the screw.

3. Pliers are not to be used on a round shank screwdriver. If heavy work is to be done, select the correct size heavy duty screwdriver with the square shank and use a wrench.

4. Screwdrivers are not to be used to check an electrical circuit. Arcing will melt the screwdriver blade; also heat will draw the temper from the metal.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:________________________________ **DATE:**______________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Screwdrivers

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of the types of screwdrivers used in electrical trades.

REFERENCE: Student Information Sheet/Learning About Screwdrivers

DIRECTIONS: Read each statement carefully. Select a word or words which will complete the statement correctly. Place your answer in the blank space to the right of each statement.

1. The two most used screwdrivers are the standard blade and the ____ head. ______________

2. Screwdriver tips are heat treated to withstand wear and ____. ______________

3. When there is insufficient space to use a conventional shank screwdriver a ____ screwdriver is used. ______________

4. The screwdriver which has been designed for use in areas where there is limited work room is a ____ screwdriver. ______________

5. If a screwdriver blade tip is too narrow for a screw slot one of two things may happen; either the screw slot will be damaged or the screwdriver tip will ____ ______________

6. A correctly ground common screwdriver blade has the sides slightly ____. ______________

7. A correctly ground common screwdriver blade helps to hold the tip more firmly in the screw slot as ____ is applied to the screwdriver. ______________

8. One hand holds the screwdriver while the other hand guides and ____ the blade with the screw. ______________

9. As the blade of a screwdriver is reground correct fit is checked by fitting it in a ____. ______________

10. A screwdriver blade that has been ground at too steep an angle will tend to twist or ____ of the slot. ____________________

11. When working with screws and connections near live wires, use an ____ insulated screwdriver, and keep hands free of any wires. ____________________

12. If it becomes necessary to hold a small unit in a hand to tighten screws, no ____ pressure is applied to the screwdriver. ____________________

13. The screwdriver with an X-shaped tip is a ____ screwdriver. ____________________

14. Hammering on a screwdriver handle, plastic or wood, will cause damage by possibly ____ it. ____________________

15. A screwdriver is not a pry bar because it does damage to the tip and ____. ____________________

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT:	Tools, Equipment, and Materials for Electrical Trades
NAME OF JOB:	Learning About Screwdrivers
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	In completing this job sheet, the student will demonstrate the ability to use a screwdriver.
TOOLS AND EQUIPMENT:	Display of screwdrivers prepared by instructor.
MATERIALS:	Used electrical boxes, switches, wire, etc.
GENERAL INSTRUCTIONS:	Follow instructions given in class.
PROCEDURES AND/OR TASKS:	1. Select one tool from the display. 2. Using proper safety procedures, demonstrate how the tool should be used. 3. Replace the tool.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

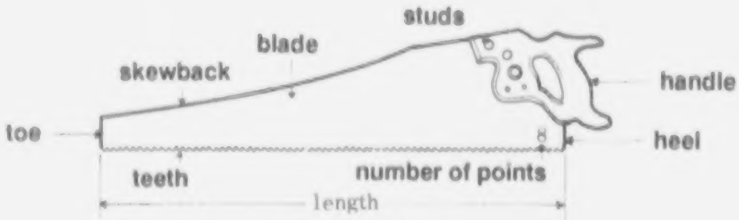
TOPIC: Learning About Saws

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be familiar with the types of saws used in electrical trades.

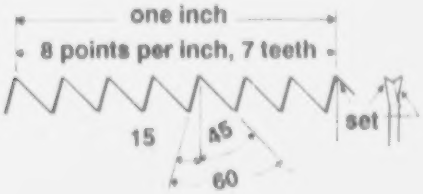
A part of the electrician's tool kit is saws. Those most commonly used are the Crosscut Handsaw, Keyhole, Hacksaw, and Power Saw.

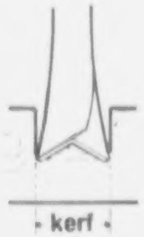
CROSSCUT HANDSAW



Skewback

Straight Back





A good crosscut saw with a tooth range of from 8 to 11 points should be included in every electrician's tool box. Saw teeth size depend on the number of points per inch. There is one more point than teeth. The number of points is very often stamped on the face at the heel, such as the illustration of the skewback handsaw.

As is indicated by the name, crosscut handsaw means the saw is designed to cut across wood grain. The saw teeth are pointed and set at an angle, every other tooth to the opposite side.

freely while cutting the wood with no binding.

Saw blades are manufactured in different shapes and lengths. The lengths for a crosscut saw vary from 20" to 28". The popular lengths are 24" to 26".

The first saw illustrated is the skewback. There is a slight curve in the back down toward the toe. This curve gives the toe of the blade greater flexibility, and a slight curve can be cut with this part of the blade. Too, the top point of the toe can be easily found and used for sighting when a cut is started.

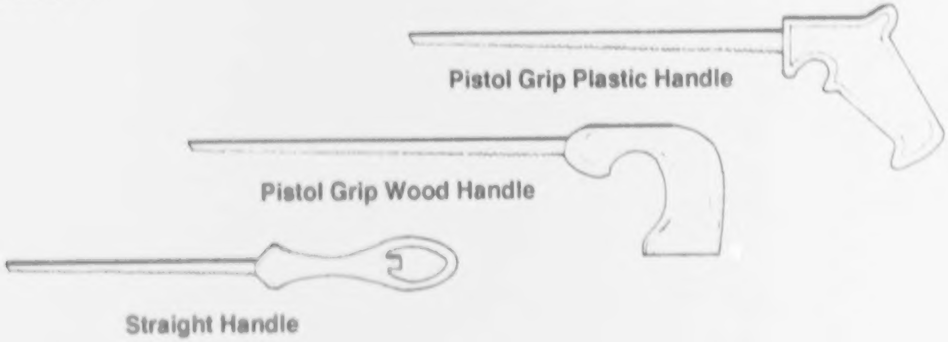
The second saw has a straight back. It is not flexible like the skewback, but it does have the advantage of being used as a straight edge for laying out lines.

Saw blades are made of spring steel. The temper in the spring steel allows the teeth to be filed and set, and as the saw is used the blade keeps its shape and the teeth maintain their cutting edge.

The saw blade face is ground and polished and may be slightly lubricated; however, all lubricants must be kept out of the teeth because it helps to clog them. The teeth edge of a blade is usually slightly thicker than the other portion of the blade. This strengthens the teeth edge, allows for less teeth set, and gives clearance for the back edge.

Saw handles are made of fine-grain hardwood and shaped to comfortably fit the hand. Handles are also moisture proofed with a durable long lasting finish. Brass studs are used to fasten handles to blades. Handles must be kept tight on blades, and this is done with the brass studs.

KEYHOLE SAW



Keyhole saws have blades about eight to ten inches in length with teeth filed in such a manner that the saw is used for ripping or crosscut. These saws are used for cutting sharp curves and openings of various shapes as may be needed for lighting fixtures and other electrical equipment.

Caution must be exercised when cutting not to bend or buckle the blade by applying too much pressure. Remember that the farther out on the end of the blade being used to saw, a lesser amount of pressure is to be used. There are times when a hole must be bored before the saw can be used to further shape the opening.

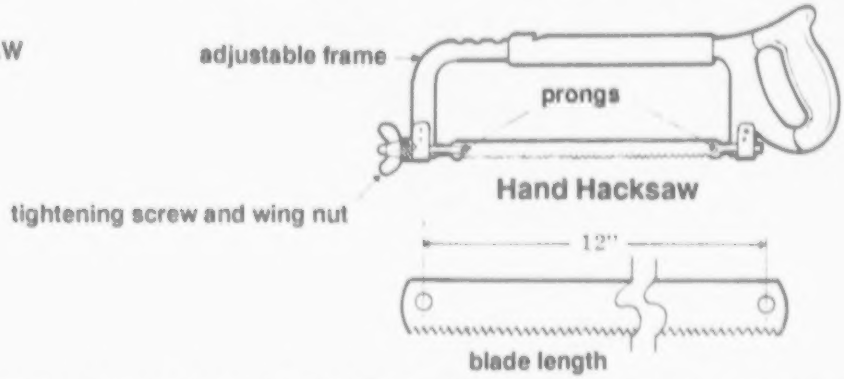
The hacksaw is used to cut heavy cable, pipe, and conduit. On occasion it becomes necessary to cut other metals; some may be heavy metal.

The hacksaw is used to cut heavy cable, pipe, and conduit. On occasion it becomes necessary to cut other metals; some may be heavy metal.

Hand hacksaw frames are available in different lengths or adjustable so that different length blades can be used. Hand hacksaw blades are available in 8", 10", and 12" lengths; however, the 10" and 12" blades are more often used. The length of a blade is determined by the distance between the centers of the blade attaching holes at each end.

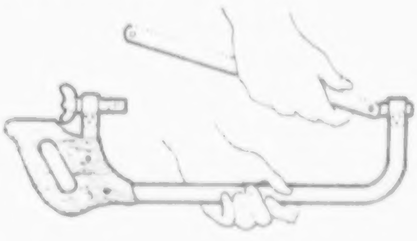
A hand hacksaw is made up of a handle, a frame, prongs, a tightening screw, a wing nut, and a blade. For the electrician it is more practical to purchase the adjustable type frame for universal use.

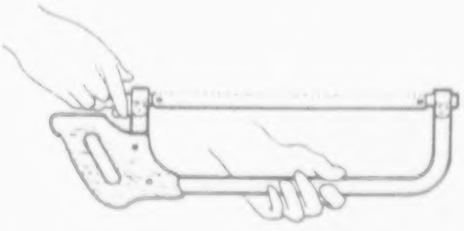
HACKSAW



To install a blade in a frame first turn the frame so that the opening for the blade is up. Position the blade with the teeth up and point away from the handle.

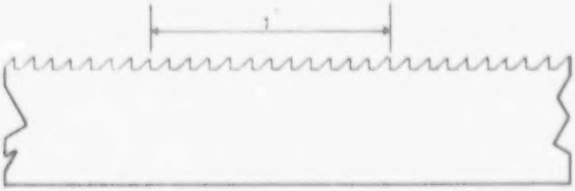
Hook the blade onto one prong and then onto the second. Tighten the blade firmly with the adjusting screw and wing nut. The blade should have no slack because a loose blade is apt to break, kink, and it will make a crooked cut.



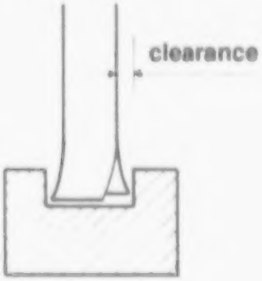


The two types of hacksaw blades are made of tool steel. The blades are hardened and tempered. One type blade is the all-hard blade which is hardened throughout. The second type blade is the flexible which has only the teeth hardened.

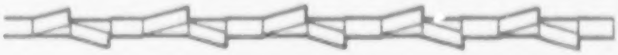
Hacksaw blades are selected for a job by the number of teeth per inch and all-hard or flexible. For heavy cross section metals select an all-hard blade. For light pipe, tubing, and light cross section metal select a flexible blade. All blades have approximately the same dimensions for thickness .025" and for width 1/2".



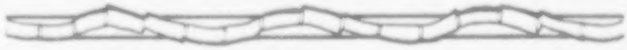
In order to cut a job in two, the teeth of a saw must cut a wider kerf (slot) than the blade is thick in order to keep the blade from binding and hanging up. In order to saw a wider kerf than the blade is thick, the blade teeth are set. Saw teeth set means that the teeth are bent right and left. Saw teeth are set either rake (alternate-set) or wave. Rake set has one tooth bent right, the next tooth bent left, and a straight tooth; then the procedure starts over. Wave set (wavy) alternately has several teeth bent left and then several teeth bent right.



Kerf Clearance



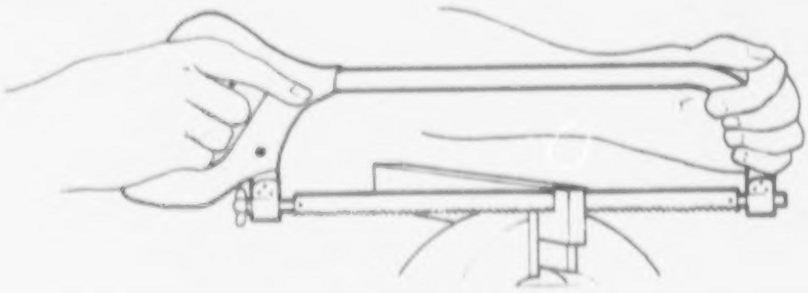
Rake Set



Wave Set

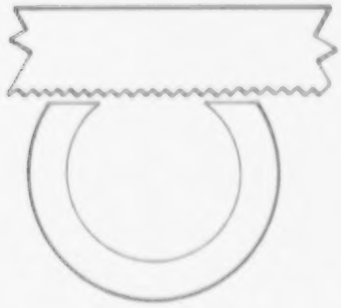
14 and 18 teeth per inch are rake set, whereas 24 and 32 teeth per inch are wave set. 14 teeth per inch blade is used for sawing large sections of mild metals. 18 teeth per inch blades are used to saw large sections of tough metals. 24 teeth per inch blades are used to saw heavy pipe, brass, copper, flat stock iron, and angle iron. 32 teeth per inch blades are used for thin wall pipes, thin wall tubing, and the like.

To make a cut with a hacksaw first notch the place where the cut will start with a file. Hold the hacksaw handle with one hand and grasp the front end of the saw frame with the other hand. Stand with the body at about a 30-degree angle to the work. Place the second foot 8" to 12" from the other foot and slightly behind it. Place the saw blade on the work piece at the file notch. Make the first saw stroke by pulling the saw back across the work piece. As the saw will cut only on the forward stroke, press down with this stroke. Raise the saw slightly on the back stroke. Use the full length of the saw blade on both strokes. The saw blade will warm up after a few strokes and some slack will occur. Tighten the tension on the blade at this time.

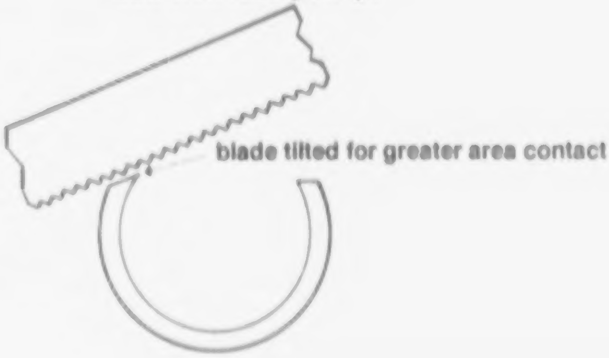


Be sure to use the correct hacksaw blade for the job. A simple rule of thumb to follow when selecting a blade is that at least two saw teeth should be contacting the area of the work piece being cut.

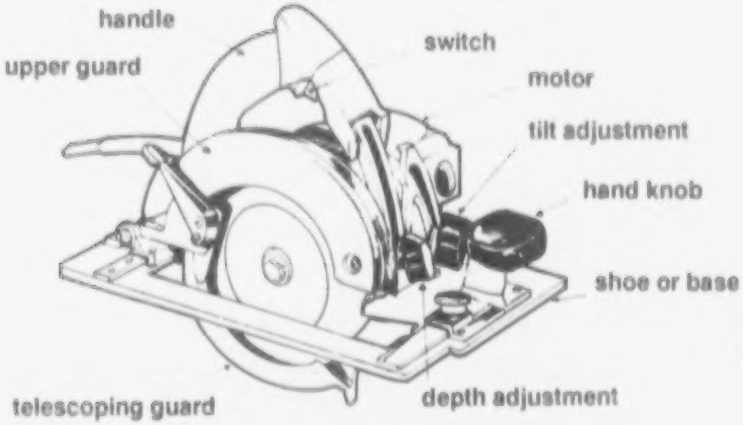
Correct Blade For Area Contact

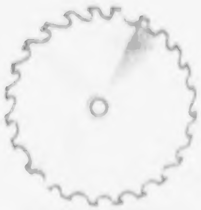


Saw Thin Tubing & Pipe


blade tilted for greater area contact

POWER SAWS


handle
upper guard
switch
motor
tilt adjustment
hand knob
shoe or base
telescoping guard
depth adjustment



Rough Cut Combination

When power is available the electric power saw reduces the time needed to perform many tasks in the electrical trades. The saw is light in weight, easy to use, and easy to handle and carry.

The first thing a person must do before operating the power saw is to become well acquainted with it. First, the way in which it operates: off and on, safety features, etc. Second, the procedures laid out for its use.

Next the operator must be wide awake and alert at all times: (1) not overly tired, (2) not ill, (3) not having worked an extended number of hours, (4) not trying to rush.

Maintain concentrated attention on work. Never distract someone else who is using the saw. To talk, listen, or size up job, shut off the power, allow the blade to stop and then conduct necessary side business.

Before performing a job with the power saw: (1) mentally think through the job, (2) plan the job thoroughly, (3) lay the job out, and (4) check the tool for proper operation, adjustments, sharp blade, etc.

Electric power is an item that must be respected. Inspect power cords for proper ground and good condition. Make sure power source is of the proper voltage for the saw. Check saw switch for OFF position before plugging the power cord into the power outlet.

The saw is fed into the workpiece very carefully and at a speed no faster than the saw will cut it easily. An overload can be hazardous. The operator may be injured, the saw can be damaged, or perhaps both.

The most popular size saws are 7" to 8". The size of a saw is determined by the largest diameter saw blade that it will take. Blade cutting depth is adjusted by raising or lowering the shoe or base. Some saws have a tilting shoe or base which makes it possible to cut a bevel. The saw is especially adaptable to making cuts in assembled work; studs, flooring, roofing, etc.

Saw blades are of four usual types. Rough Cut Combination - This is the most popular because it is a free-cutting general purpose blade for cutting in any direction: ripping, crosscutting, mitering on both hard wood and soft wood. Rip - sawing with the grain. Crosscut - cutting across the grain. Master Combination (Standard Combination or Miter) - This is an all purpose blade giving a smooth fast cut. Cuts crosscut, rips, miters for general use. There are other specialty saws for paneling, flooring, etc. Some blades have carbide tips which cause the blades to have a longer life and stay sharper longer. Saw blade teeth set is about 2 1/2 gauges to each side of the blade. This gives more clearance in the saw kerf and allows the saw to be guided "free-hand" along a layout line.

To operate a power saw:

1. Grasp the handle with a firm grip of one hand.
2. Index finger of that hand is positioned to operate the trigger switch.
3. Position the shoe or base on the work.
4. Align the blade guide mark with the layout line.

5. Rest the other hand on the work but out of danger of being cut by the saw.

6. Pull the trigger switch and permit the saw to reach maximum speed.

7. Feed the saw evenly and smoothly into the work.

8. Release the trigger switch when the cut is completed; allow the blade to come to a stop.

9. Now the saw may be set aside, stored, or whatsoever.

Safety

1. Material to be cut is positioned and supported in such a manner as not to allow the kerf to close and bind the saw blade during or at the end of a cut.

2. This material must be supported very near the point of cut.

3. Small or short workpieces are to be clamped to a bench or sawhorse.

4. Take care not to cut into nails, sawhorse, or supporting base.

5. Depth of cut must be adjusted to the thickness of the material plus approximately 1/8".

6. Check all adjustments for tightness and that blade is firmly attached to arbor.

7. Position power cord in such a manner that it will not become tangled in the saw and work.

8. Place saw shoe or base on the work, making sure the blade is clear before turning on the saw switch.

9. Stand to one side of the kerf as the cut is being made.

10. Keep hands from under the material being cut.

11. The power cord must be removed from the power outlet before a saw is adjusted or a blade is changed.

12. Select and use a blade that is sharp and properly set.

13. Wear goggles.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ____________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Saws

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of the types of saws used in electrical trades.

REFERENCE: Student Information Sheet/Learning About Saws

DIRECTIONS: Read each of the following statements carefully before making a mark. Some of the statements are true and some are false. Indicate the answer selected by placing a small circle around the T or F in the corresponding right hand column.

1. Handsaws most commonly found in the electrician's tool box are the ripsaw, keyhole saw, hacksaw, and power saw. T F

2. Handsaw teeth size depend on the number of points per inch. T F

3. The number stamped on the heel of the saw is the number of teeth per inch. T F

4. The teeth side of handsaw blades is usually thicker than the opposite side of the blade. T F

5. Teeth are set on a handsaw to give the cutting side more rigidity and strength. T F

6. The skewback handsaw has a curve in the back down toward the toe; this gives the toe of the blade more flexibility. T F

7. A keyhole saw has ripsaw teeth. T F

8. When the end of a keyhole saw is being used to saw with, more pressure on the saw is needed because of the teeth size and distance from the handle. T F

9. Hacksaw blades come in lengths of 8", 10", and 12". T F

10. Hacksaw blade length is measured from tip of blade to tip of blade. T F

11. Hacksaw blade teeth are pointed toward the handle because cutting is done on the back stroke. T F

12. Hacksaw blades of 24 to 32 teeth per inch are wave set. T F

13. A rule to follow when selecting a hacksaw blade is that at least two teeth should contact the area of the workpiece being cut. T F

14. The size of a portable power saw is determined by the depth that it will cut. T F

15. Ease of free-hand sawing with a portable power saw is accomplished by saw teeth set to either side of the blade. T F

16. The portable power saw base is placed on the workpiece with the teeth clear of the work before the power is turned on. T F

JOB SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

NAME OF JOB: Learning About Saws

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to use a saw.

TOOLS AND EQUIPMENT: Display of saws prepared by instructor.

MATERIALS: Used conduit and boards

GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

1. Select one tool from the display.
2. Using proper safety procedures, demonstrate how the tool should be used.
3. Replace the tool.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

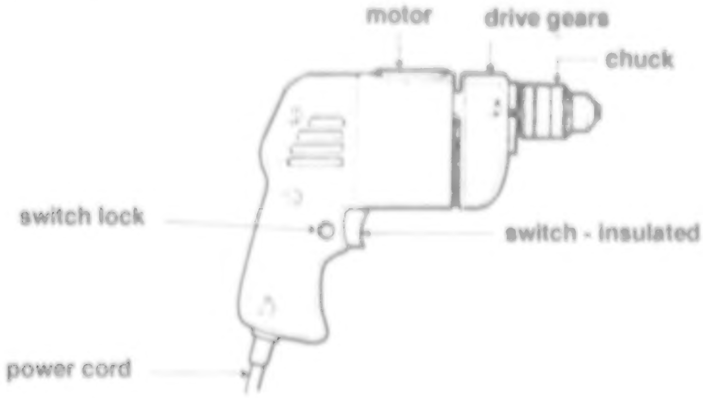
TOPIC: Learning About Drilling Tools and Equipment

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be familiar with the use of drilling tools and equipment in electrical trades.

Either power driven or manual drilling equipment and tools are needed to make holes in both new construction and reworked structures for the installation or reworking of conduit and wire.

ELECTRIC POWER DRILL



Electric portable drills come in different sizes and a variety of types. The size of an electric portable drill is determined by chuck size. The chuck is that part of the drill that holds the drill bit. The three most used electric portable drills are 1/4", 3/8", and 1/2"; however, there are other sizes.

Later model drill motors have variable speeds and are reversible. As in the illustration, probably the most popular type drill is the pistol grip type. This is because of its versatility and flexibility.

To use the electric portable drill:

1. Select the proper size bit, twist drill, hole saw, etc.
2. Inspect drilling or cutting accessory for good condition and sharpness.
3. Install accessory in chuck and tighten chuck firmly with chuck key.

4. Position point of accessory on center point of hole to be made.

5. Hold drill at correct angle; start electric drill motor.

6. Apply pressure evenly and smoothly, feeding the hole cutting device into the workpiece.

   CAUTION: Bit, twist drill, or hole saw is not to be wobbled as the hole is being made.

7. Back the bit, etc. out as needed to clear away shavings or waste.

8. Ease up on pressure as you feel the tool go through the workpiece.

9. Back the tool out of the finished hole.

10. Shut off motor.

DRILL AND DRILLING SAFETY

1. Check electrical connections and power cord for good condition.

2. Loose stock must be held firmly in position before drilling.

3. Electric power drill is to be connected to a properly grounded power outlet with switch in off position.

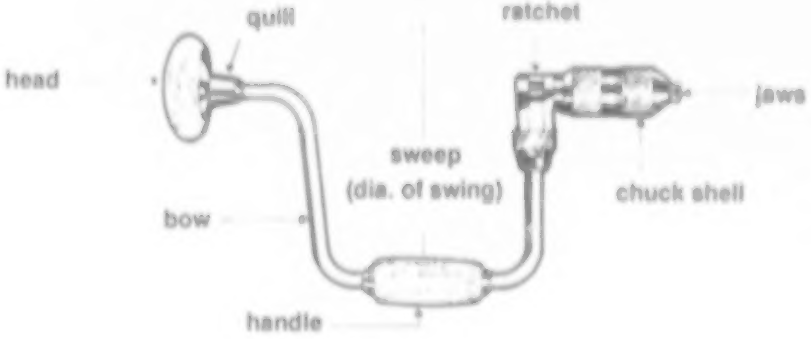
4. Remove bit or other tool from drill check as soon as work is completed.

5. Loose clothing is not to be used when using an electric power drill.

6. Long hair must be tied back or covered.

7. Wear goggles.

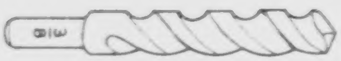
BRACE



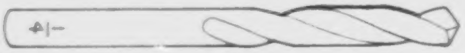
The brace is a tool designed to hold various types of square shank bits. The brace illustrated here is of the ratchet type. The sweep or diameter of the swing of the brace handle is the diameter of the circle which the handle makes when revolved. The ratchet allows for the altering of the swing, permitting circle which the handle makes when revolved. The ratchet allows for the altering of the swing, permitting holes to be bored near walls, corners, or ceilings where a complete turn of the handle cannot be made.

A bit is inserted into the chuck jaws and the jaws are tightened by grasping the chuck shell with one hand and twisting to the right.

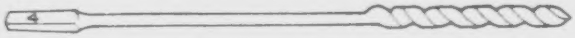
DRILLING EQUIPMENT



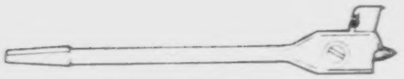
Masonry Bit



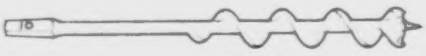
Twist Drill



Wood Twist Bit



Expansive Bit



Auger Bit

The auger bit is used to drill holes in wood or other soft materials, but not metal. The common range of sizes is from 1/4" to 1". There are other sizes available. The size is stamped on the shank or tang. This is often a whole number which indicates the number of sixteenths.

The tip of the bit is a screw. This screw centers and pulls the bit into the material. The electrician usually uses a coarse screw. The coarse-screw bit is usually used by an electrician for rapid cutting.

On either side of the screw are spurs or nibs which score the outer edge of the chip which is removed by the cutting edge or lip. From there the chips feed into the throat and out the twist. These bits may have a solid center, as illustrated, single twist, or double twist.

Expansion bits are used for boring holes in excess of 1". Cutter blades of different lengths are available. The blades are calibrated and adjusted in or out as needed. They are available to bore holes up to 4".

Wood twist bits have points ground to an included angle of 60 degrees for entering wood easily. They range in size from 1/8" to 1/2" in increments of thirty-seconds of an inch. The number of thirty-seconds is stamped on the tang.

High speed twist drills are used with the electric power drill. They are for drilling metal.

The masonry drill has a 1/4" round shank. The drill size is indicated on the drill bit shank. There are numerous sizes but the usual are 3/16", 1/4", 5/16", 3/8", and 1/2". There are those drill bits that have carbide tips. The masonry drill makes it possible for the electrician to install anchor bolts and the like in hard surfaces.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________ **DATE:** ______________

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Drilling Tools and Equipment

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of drilling tools and equipment used in electrical trades.

REFERENCE: Student Information Sheet/Learning About Drilling Tools and Equipment

DIRECTIONS: Read each statement carefully. Select a word or words which will complete the statement correctly. Place your answer in the blank space to the right of each statement.

1. Holes in structures are drilled or cut by the electrician for the installation of ____ and wire. ________________

2. The size of an electric portable drill is determined by the ____ size. ________________

3. Because of its versatility and flexibility, the most popular type portable electric drill is the ____ type. ________________

4. To drill a hole, position the point of the drill on the ____ of hole to be drilled. ________________

5. An electric power drill is to be connected to a properly ____ power outlet with switch in "off" position. ________________

6. The brace is a tool designed to hold various types of ____ shank bits. ________________

7. The ratchet type brace allows for the altering of the ____, permitting holes to be bored near walls, corners, or ceilings. ________________

8. The tip of an auger bit is a screw which centers and ____ the bit causing the wood or soft material to be drilled or bored. ________________

9. The electrician usually uses an auger bit with ____ threads. ________________

10. On either side of the auger bit screw are ____ which score the chip. ________________

11. Expansion bits are used to bore holes in excess of ____. ________________

12. Wood twist bits have a point which is ground to an included angle of ____ degrees. ________________

13. The wood twist bit point is ground to the angle of 60 degrees for entering ____ easily. ________________

14. High speed twist drills are used for drilling ____. ________________

15. The masonry drill bit makes it possible for an electrician to install anchor bolts and the like in ____ surfaces. ________________

JOB SHEET

ELECTRICAL TRADES I

NAME: ________________________________ **DATE:** ____________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

NAME OF JOB: Learning About Drilling Tools and Equipment

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to use drilling tools or equipment.

TOOLS AND EQUIPMENT: Display of drilling tools or equipment prepared by instructor.

MATERIALS: Used sheets of metal, boards, etc.

GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

1. Select one tool from the display.
2. Using proper safety procedures, demonstrate how the tool should be used.
3. Replace the tool.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

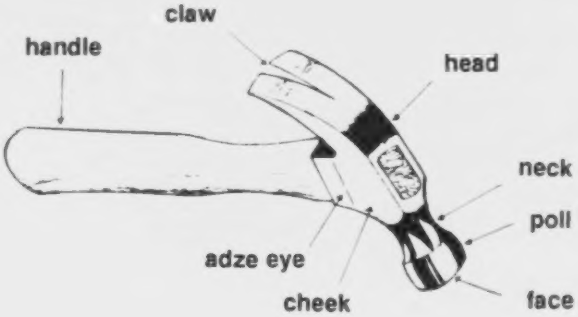
TOPIC: Learning About Hammers

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be familiar with the types of hammers used in electrical trades.

Hammers are a part of the electrician's tool kit for nailing, fitting, and use with chisels. There are few trades that do not use a hammer at all. But for the most part, it is a necessary tool that can and does fill a necessary requirement.

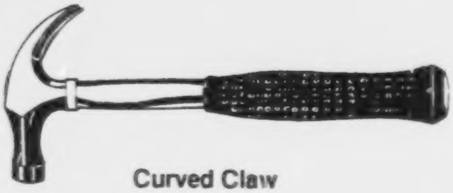
CLAW HAMMER



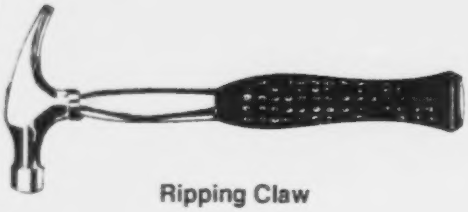
This is a common tool for the driving of fasteners, removal of fasteners, driving nail sets, used with wood chisels, etc. There are techniques of holding, using, and maintaining this tool that should be learned before taking on a task which requires its use.

A good hammer is made of quality alloy drop forged steel. When these heads are tempered and treated properly, they are much stronger than ordinary steel.

The claw hammer is sized by the weight of its head. Common sizes are 7 oz., 16 oz., and 20 oz. The 16 oz. hammer is the general purpose tool, whereas the 20 oz. is the heavy duty tool. Therefore, hammers are selected according to the weight best suited to the task.

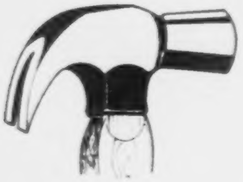


Curved Claw



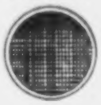
Ripping Claw

There are two types of claw hammer heads, the curved claw which is more adaptable to the removal of nails and fasteners and the straight claw or ripping claw hammer which is adaptable to prying wood construction apart.

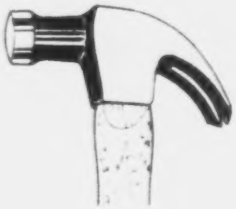


Plain Faced

Smooth



Cross-Checkered

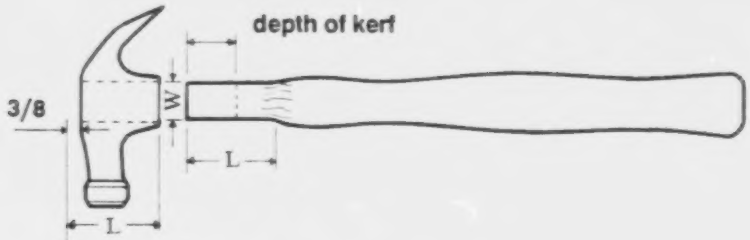


Bell Faced

Claw hammers have different type faces. The plain faced is more or less flat and used for rough work because it has a tendency to leave face marks when driving fasteners. A bell face is slightly convex in shape; therefore, it is more difficult to use because of the tendency to slip off a fastener or bend it. More practice and skill is needed to use this hammer. Advantages of the bell face is that it has less tendency to leave face marks in the work. Fasteners can be driven flush or even slightly below surface level with little or no marks left.

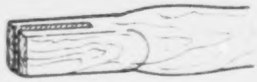
Also, hammer faces may be smooth or checkered. Checkered faces naturally have less tendency to slip off the surface being hammered, but they do leave the checkered marking on hammered surfaces.

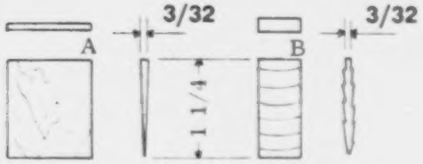
WOOD HAMMER HANDLE REPLACEMENT



saw cut in end of handle

for wooden wedge


Kerf



Wood Wedge

Metal Wedge

1. Remove old handle. Saw off near eye.

2. Remove remainder of handle from eye. Drive out front side of eye, use chisel or punch.

3 Shape new handle to fit back side of eye. Hold handle in wood vise; use spoke shaver and wood file.

4. Shape end of handle and align with remainder of handle. Shape to taper allowing handle to protrude 3/8" beyond front of eye.

5. Make saw kerf in tapered end of handle. To receive wood wedge, use handsaw for larger handles, backsaw for smaller handles. Saw kerf depth to 3/4 width of hammer eye.

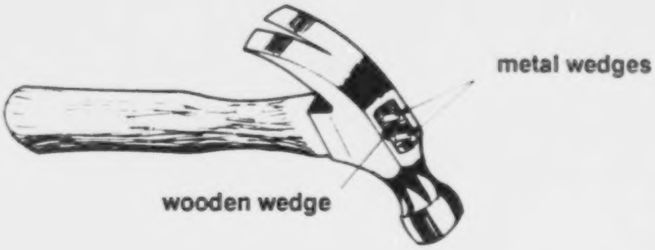
6. Drive handle into eye. Handle to extend 3/8" beyond eye. Hold handle upright, hammer head at top end. Grasp handle near center and bring butt end down sharply on a solid piece of wood until driving is completed.

7. Prepare wood wedge. Approximately 3/32" thick, same width as hammer eye height, and approximately 1 1/4" long.

8. Drive wood wedge in kerf of hammer handle to maximum tightness.

9. Saw off 1/4" of handle protruding through hammer eye.

10. Make starting grooves for metal wedges in 1/8" portion of handle protruding from hammer eye. Two grooves at slight diagonal across end of handle. Use hammer and cold chisel.

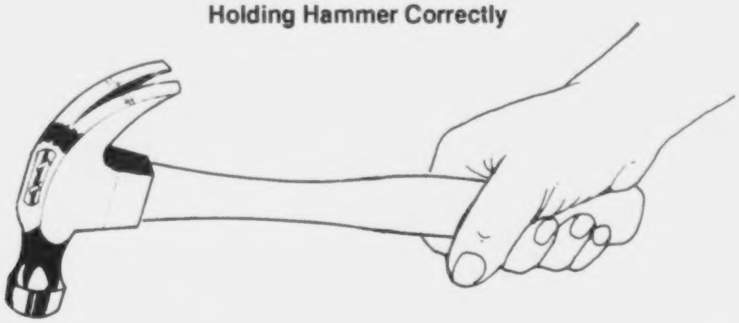


11. Drive metal wedges. Use flat of ball peen hammer. Drive to maximum depth.
12. Cut off remaining 1/8" inch of handle protruding through hammer eye. Use hacksaw.
13. Finish handle end and wedges. Use coarse double-cut file. Hammer head is not to be scored with file.

USE THE HAMMER

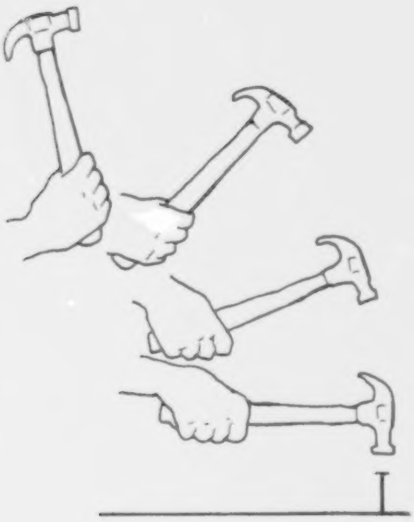
Rub the face of a hammer with a piece of sandpaper to clean grease and dirt off the face. Grease or dirt can cause the hammer to slide or slip off the object being driven.

Holding Hammer Correctly



Grasp the handle firmly with one hand near the end of the handle. This gives more leverage for driving power and one reason for practice in using a hammer.

Use the Arm and the Wrist

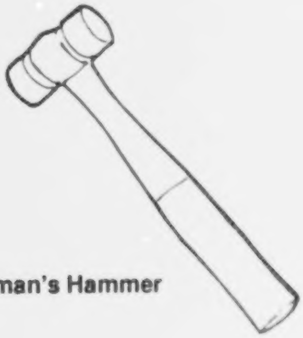


Driving is done with well directed blows of the hammer. In driving with the hammer it is desired that the object, nail, etc., be hit squarely and as near in the center of the hammer face as possible.

Hammer blows are made with the muscular action of the wrist, elbow, and shoulder. Depending upon the force of the blow, one or all of these actions may be used. Light hammering is done with the wrist and some little elbow motion. As the intensity of the hammering increases wrist action is used with increased elbow action. Heavy hammering requires wrist action, elbow action, and shoulder action.

Lineman's Hammer:

This hammer is designed for pole-line work. It has weight for driving in lag bolts, hooks, and the like. The hammer is made of tempered steel. The head is 3 3/4" long with twin faces round crowned and 1 3/4" in diameter. The hammer weight is 36 oz. with an overall length of 14". This hammer lends itself to being used in confined places.



Lineman's Hammer

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________ **DATE:** ______________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Hammers

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of the types of hammers used in electrical trades.

REFERENCE: Student Information Sheet/Learning About Hammers

DIRECTIONS: Read each of the following statements carefully before making a mark. Some of the statements are true and some are false. Indicate the answer selected by placing a small circle around the T or F in the corresponding right-hand column.

1. Claw hammers are sized by the weight of the head. T F
2. A 20 oz. claw hammer is considered the general purpose type and is used as such. T F
3. The straight claw hammer is adapted for pulling nails and other fasteners. T F
4. The bell face claw hammer is more difficult to use, but it is less apt to leave hammer marks on the workpiece. T F
5. A plain face claw hammer is used for rough work. T F
6. New wooden hammer handles are driven to the eye of the head with the flat of a ball peen hammer. T F
7. Wooden wedges are driven into kerf of a new wooden hammer handle 1 1/4 inches. T F
8. To use a hammer, the handle is grasped near the end. T F
9. Hammer blows are made with the muscular action of the wrist, elbow, and shoulder. T F
10. A lineman's hammer is designed so that it can be used in confined places. T F

JOB SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

NAME OF JOB: Learning About Hammers

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to use a hammer.

TOOLS AND EQUIPMENT: Display of hammers prepared by instructor.

MATERIALS: Nails, boards, etc.

GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

1. Select one tool from the display.
2. Using proper safety procedures, demonstrate how the tool should be used.
3. Replace the tool.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

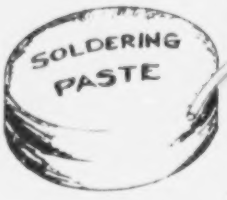
TOPIC: Learning About Soldering Equipment and Supplies

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

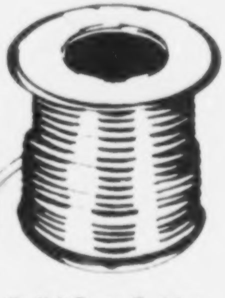
SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be familiar with the soldering equipment and supplies used in electrical trades.

For electrical work, splices, taps, etc., solder is used unless solderless connectors are installed. A good solder joint is stronger both mechanically and electrically.

SUPPLIES



Soldering Paste

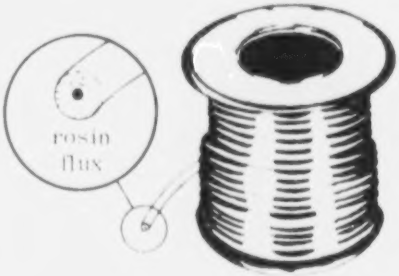


Solid Core Solder

Solder for electrical work is an alloy of tin and lead. The most popular is 60% tin and 40% lead. The lead content determines the melting point and the tin lends strength.

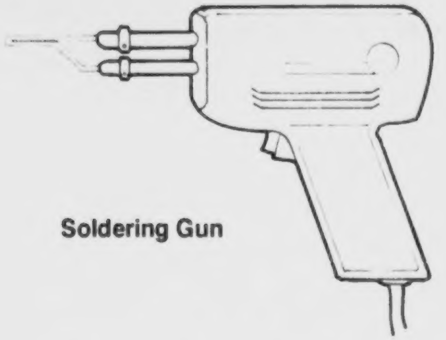
Solid core requires a flux (soldering paste). This removes oxidation and other foreign material from splice or tap. The flux is a noncorrosive material.

On small jobs rosin core solder is preferred because the flux is in the center of the solder and cleaning action takes place as the task is performed.

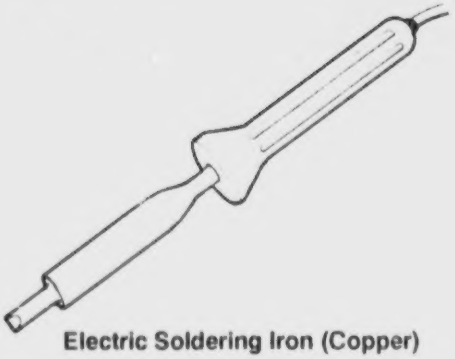


Rosin Core Solder

ELECTRIC POWER SOLDERING EQUIPMENT



Soldering Gun

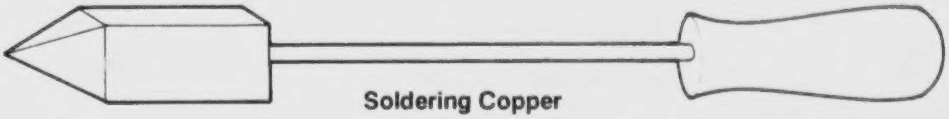


Electric Soldering Iron (Copper)

The soldering gun is very adaptable to electrical tasks. It is light and very flexible in use. Different shapes of tips are available and may be replaced as needed. It gets hot rapidly, which speeds up the task.

The electric soldering iron has two type tips: wedge and square. It will hold a uniform heat. The electric soldering iron is available in a wide range of sizes.

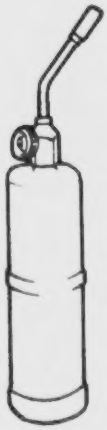
SOLDERING COPPER



Soldering Copper

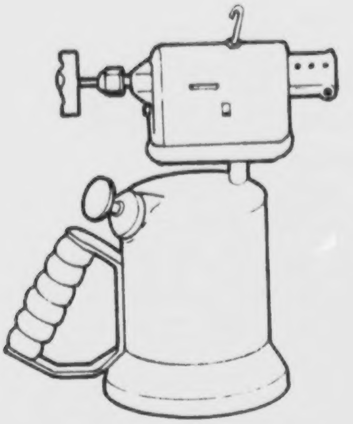
The soldering copper may either be a square or octagonal shaped piece of copper with a point which is a tapered square or a wedge shape. They are usually purchased in pairs. One may be used while the second is heating. Coppers range in weight from 1/2 pound to 14 pounds per set. These soldering coppers must be heated from an outside source such as a propane torch, gasoline blow torch, or gasoline or gas fired furnace. Tips of coppers are cleaned and shaped with a file. All soldering tips must be tinned (coated with solder). The tinning makes the handling of solder easier.

TORCHES

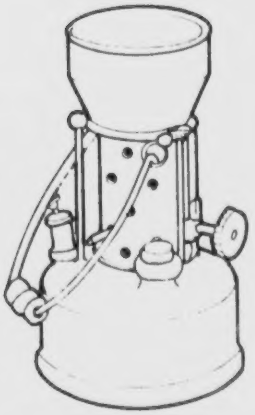


Propane

The propane torch is a self contained heating unit. For larger soldering jobs it can be used directly, eliminating the soldering copper. However, it can be used to heat a soldering copper. It is clean to use, comparatively safe if used properly, and easy to store.



Gasoline Blow Torch



Gasoline Furnace

The gasoline blow torch and gasoline furnace must be operated with extreme care because there is considerable danger of an explosion, fire, or both. Gasoline is stored in the container under pressure from the pumps. These two heating units will furnish a very hot flame.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Soldering Equipment and Supplies

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of the use of soldering equipment used in electrical trades.

REFERENCE: Student Information Sheet/Learning About Soldering Equipment and Supplies

DIRECTIONS: Read each statement carefully. Select a word or words which will complete the statement correctly. Place your answer in the blank space to the right of each statement.

1. A flux must be used with ____ solder. ______________
2. For small soldering jobs the ____ solder is preferred. ______________
3. Solder is an alloy with a smaller percentage of lead which determines the ____ point. ______________
4. The electric solder gun is very adaptable to electrical work and has the advantage of heating quickly which ____ the job. ______________
5. One advantage of the electric soldering copper is that it holds a ____ heat. ______________
6. All soldering tips must be tinned to make the handling of ____ easier. ______________
7. Soldering copper tips may be tapered square in shape or ____ shaped. ______________
8. Soldering coppers are purchased in ____. ______________
9. The propane torch is a self contained ____. ______________
10. If a very hot flame is needed, a ____ torch can be used. ______________

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

NAME OF JOB: Learning About Soldering Equipment and Supplies

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to use soldering equipment.

TOOLS AND EQUIPMENT: Display of soldering equipment prepared by instructor.

MATERIALS: Soldering supplies

GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

1. Select one tool from the display.
2. Using proper safety procedures, demonstrate how the tool should be used.
3. Replace the tool.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Measuring Tools

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

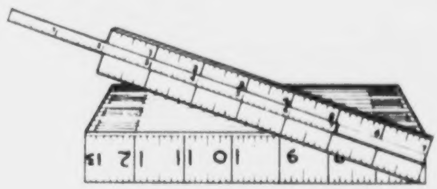
SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be familiar with measuring tools used in electrical trades.

The electrician uses measuring tools for lengths of wire, sizes of openings, lengths of conduit, and other measurements.

In laying out work accurately the electrician must first select the correct tool, second, use the tool correctly, and third, be able to read the measuring tool correctly.

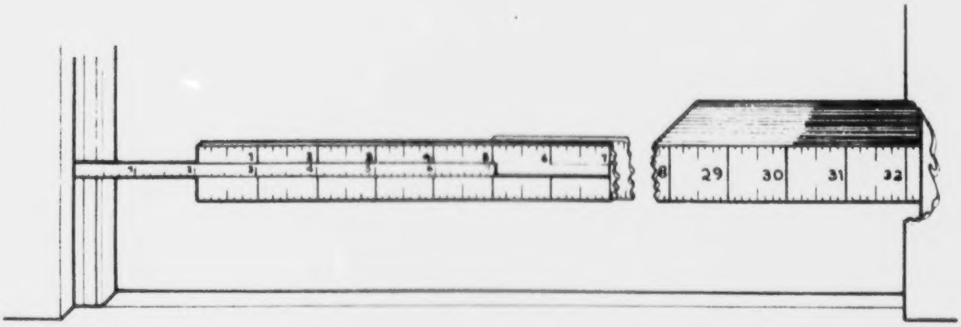
Measurements made by the electrician will vary according to the type job to be done. For long measurements the steel tape is used. Shorter measurements and openings are made with the push-pull rule or the folding extension rule. Regardless of the type rule they all have the same system of linear measure.

FOLDING EXTENSION RULE



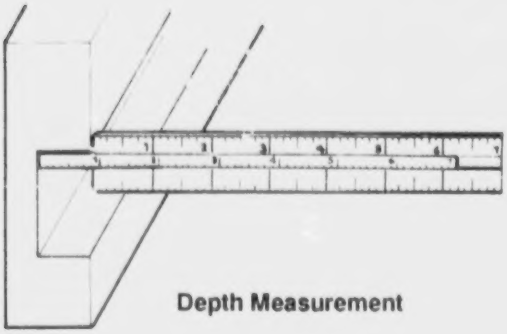
Extension Rule

The extension rule has a brass slide located in the first joint. The brass slide can be extended beyond the joint or removed from the joint. This is a zigzag folding type rule. It may be used to measure length, take inside measurements, or take depth measurements.



Inside Measurement

For inside measurements the graduations on the slide are added to the measurements on the rule.

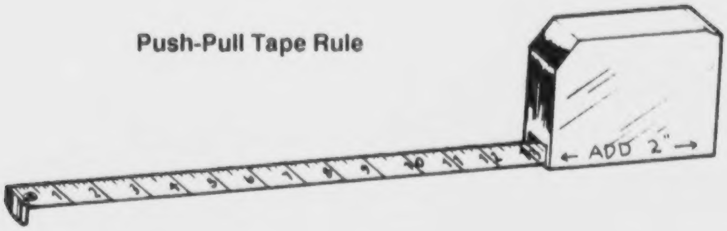


Depth Measurement

Depth measurements are taken directly from the slide. The end of the first joint acts as the stop, and it is at this point that the reading is taken.

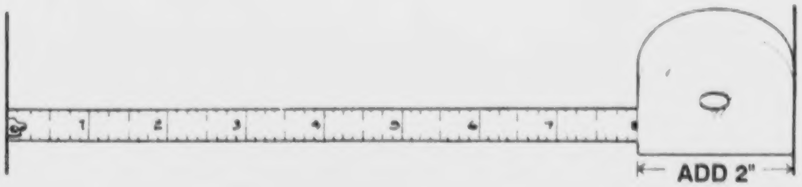
POCKET OR PUSH-PULL TAPE RULE

Push-Pull Tape Rule

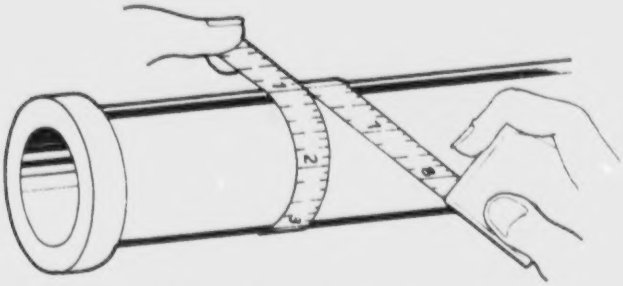


The push-pull rules are usually manufactured in lengths of from 6 feet to 20 feet. On the flat edge of the case there is an add inch. In the illustration, the add 2" means that the case is 2" long. For inside measurements, this 2" is added to the graduations indicated on the tape.

Graduations are printed on one side of the tape only. Usually the tape is graduated in 1/16" on both edges; however, some tapes may have the first few inches graduated in 1/32". The tape has a hook fitted to the end for ease of positioning and holding tape in place for a measurement.



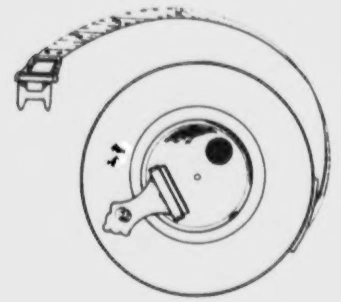
Add 2" of case length to tape measurement for inside measurement.



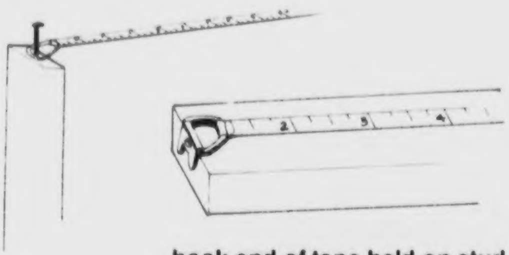
Circumference Measurement

The tape is looped closely around the cylinder. Graduations are matched and the reading taken. In the illustration the one inch and the seven inch graduations match. To find the circumference of the cylinder, one inch must be subtracted; thus the cylinder has a six inch circumference.

STEEL TAPE



ring end of tape held on nail



hook end of tape held on stud, corner, or end

The steel tape can be used to measure lengths up to 200 feet. Different types of steel tapes are manufactured to meet special requirements. The flexible spring steel tape is stamped on one side in graduations of feet, inches, half inches, quarter inches, eighth inches, and some tapes will have sixteenth inches.

These tapes may have a ring or eye on the end or a hook. In some cases both will be present. The ring is used to hook over a nail to anchor the tape for measurements. The hook anchors a tape over the end of a board, side of a stud, or at a corner for measurement.

The tape case is usually round in shape. There is a winder on one side. The winder is hinged allowing it to be folded up flush with the case. The handle fits in a hole in the case, locking the winder in the closed position. To open the winder, simply push on the handle from the opposite side from the winder.

To uncoil the flexible steel ribbon from the case, pull it outward straight. It is not to be folded backward from the opening. This will damage the tape.

When the tape is unwound, do not twist or step on it. This can cause the tape to kink, become bent, or crack. If the tape sticks as it is being retrieved or extended, simply lay the case flat and tap it on a flat surface. This will even up the spirals of tape and free it.

The tape must be treated with oil at frequent intervals. The oiling should be increased if the tape is used in wet or damp weather.

To oil the tape:

1. Uncoil the tape - laying it out straight.
2. Dampen a lint free rag with oil.
3. Hold the oily rag around the tape.
4. Wind the tape into the case.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________ **DATE:** ______________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Measuring Tools

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of measuring tools used in electrical trades.

REFERENCE: Student Information Sheet/Learning About Measuring Tools

DIRECTIONS: One item from column I is closely related to or associated with an item in column II. Place the capital letter of the associated term in column II in the blank space at the left of the number in column I.

		Column I		Column II
_____	1.	A zigzag folding type of rule.	A.	Push-pull tape
_____	2.	Add two inches of case length to tape measurement.	B.	Extension rule
_____	3.	Used to measure lengths up to 200 feet.	C.	Hook
_____	4.	Tape manufactured in lengths of from 6 to 20 feet	D.	Brass slide
_____	5.	Printed on one side of the tape only.	E.	Inside measurement
_____	6.	Can be extended beyond the joint.	F.	Graduations
_____	7.	Positions or holds tape in place.	G.	Steel tape

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT:	Tools, Equipment, and Materials for Electrical Trades
NAME OF JOB:	Learning About Measuring Tools
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	In completing this job sheet, the student will demonstrate the ability to use a measuring tool.
TOOLS AND EQUIPMENT:	Display of measuring tools prepared by instructor.
MATERIALS:	Boards of various lengths, electrical boxes, etc.
GENERAL INSTRUCTIONS:	Follow instructions given in class.
PROCEDURES AND/OR TASKS:	1. Select one tool from the display. 2. Using proper safety procedures, demonstrate how the tool should be used. 3. Replace the tool.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

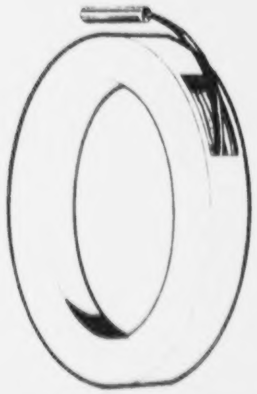
TOPIC: Learning About Fishing Tools and Materials

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

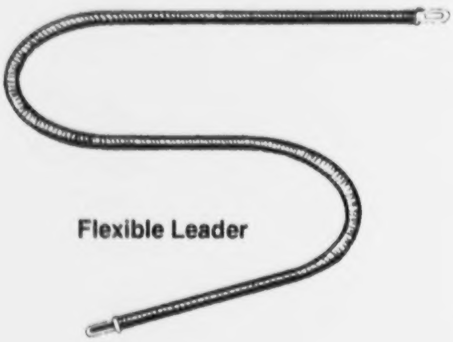
SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be familiar with the use of fishing tools and material used in electrical trades.

With conduit and various outlet boxes installed and other roughing completed, the electrician is ready to pull wires in for the different circuits.

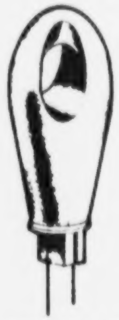
FISH TAPE



Steel Fish Tape Reel and Puller



Flexible Leader



Smooth Ball Leader

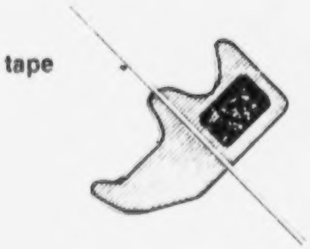
The fish tape is used to pull wires through conduit of new construction and through wall or ceiling openings in reconditioning or add-on for older structures.

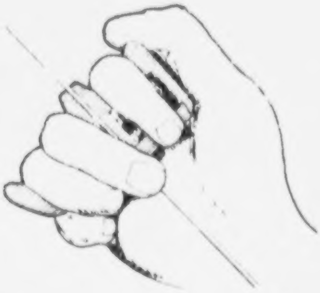
Fish tape is a flat piece of tempered steel in lengths of 50', 100', and 200'. The tape is coiled into a reel which prevents it from twisting and tangling. Fish tape is manufactured in three thicknesses: .030", .045", and .060". Manufactured widths are 1/8", 3/16", and 1/4". The most used tape has a thickness of .060" and a width of 1/8"; this is the most sturdy and will withstand a heavy pull.

If the tape does not have an attached leader, there are two that may be used. One leader is known as a flexible terminal strip (flexible leader) and the other is a smooth ball type. Each is slotted to slip over the tape and clamped in place. Either one makes fishing a much easier task by doing away with the trial-and-error method of pushing a tape through a difficult conduit run.

When a tape has been fed through a run of conduit, wires are fastened through the eye of the leader and pulled out the other end.

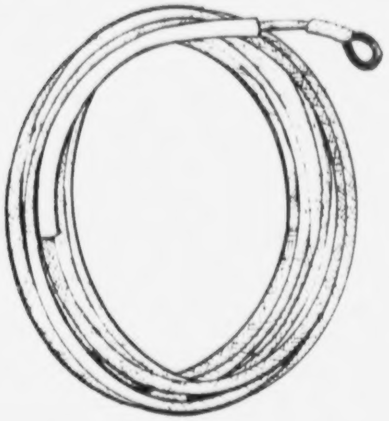
PULLER




Use

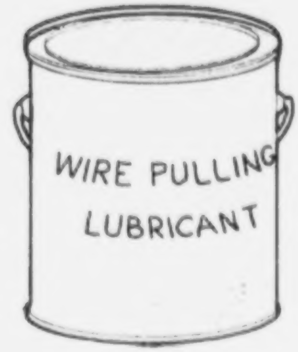
In some cases the pulling process requires a rather heavy pull; therefore, to make it easier some form of puller handle is used. Some tape reels have a locking device to make the tape stationary and the reel is used as a puller. The illustration shows another type puller. It is slotted to slip over the tape. With pressure applied by the grip of the hand the puller binds the tape and pulling can be done. Take care not to rock the hand back or forward as it may kink the tape.

FLEX FISH TAPE



This may be made of braided polyethylene or spiral-wound, multi-layer flexible steel cable. They are approximately 3/16" in diameter and are available in lengths of 25', 35', 50', 75', and 100'. This type of tape comes equipped with large eye loops in each end. The best of these tools will withstand a pull of about 500 lbs. They will pull wire through all types of conduit: aluminum, plastic, and flex. They are reported to be easier to push through tight twists and turns than flat tape. They may be used as leaders for flat tapes.

WIRE PULLING LUBRICANT



When conduit construction is long, complicated with bends or tight twists and turns which cause conductors to bind or stick, the conductors are coated with a pulling lubricant. Lubricants are non-corrosive substances with a lack of moisture, oils, and the like. Wire pulling lubricants may be talc, soapstone, flax soap, or a combination thereof. Lubricant is applied to the wires as they enter the far end of a run.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:____________________________________ **DATE:**__________________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Fishing Tools and Materials

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of fishing tools and materials used in electrical trades.

REFERENCE: Student Information Sheet/Learning About Fishing Tools and Materials

DIRECTIONS: Below are questions that are to be answered in complete sentences and in as few words as possible. The assignment is designed to include correct spelling and the use of correct trade terms.

1. What are two uses for which fish tape is used?

2. What is the most used size fish tape?

3. What devices are used to help fish steel to pass around bends in a run of conduit?

4. What means are used to pull a tape after it has been fed through a conduit run?

5. What are two types of flex fish tape?

6. How are the ends of a flex fish tape equipped?

7. What is a second use for a flex fish tape?

8. What action is taken if wires being pulled bind or stick?

9. What are some of the lubricants used to assist with a pull?

JOB SHEET

ELECTRICAL TRADES I

NAME: ______________________ **DATE:** ______________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

NAME OF JOB: Learning About Fishing Tools and Materials

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to use a fishing tool.

TOOLS AND EQUIPMENT: Display of fishing tools prepared by instructor.

MATERIALS: Electrical wire, conduit, practice wall

GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

1. Select one tool from the display.
2. Using proper safety procedures, demonstrate how the tool should be used.
3. Replace the tool.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

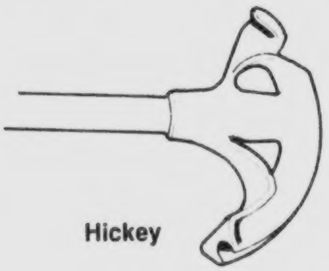
TOPIC: Learning About Conduit and Pipe Tools

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be familiar with the conduit and pipe tools used in electrical trades.

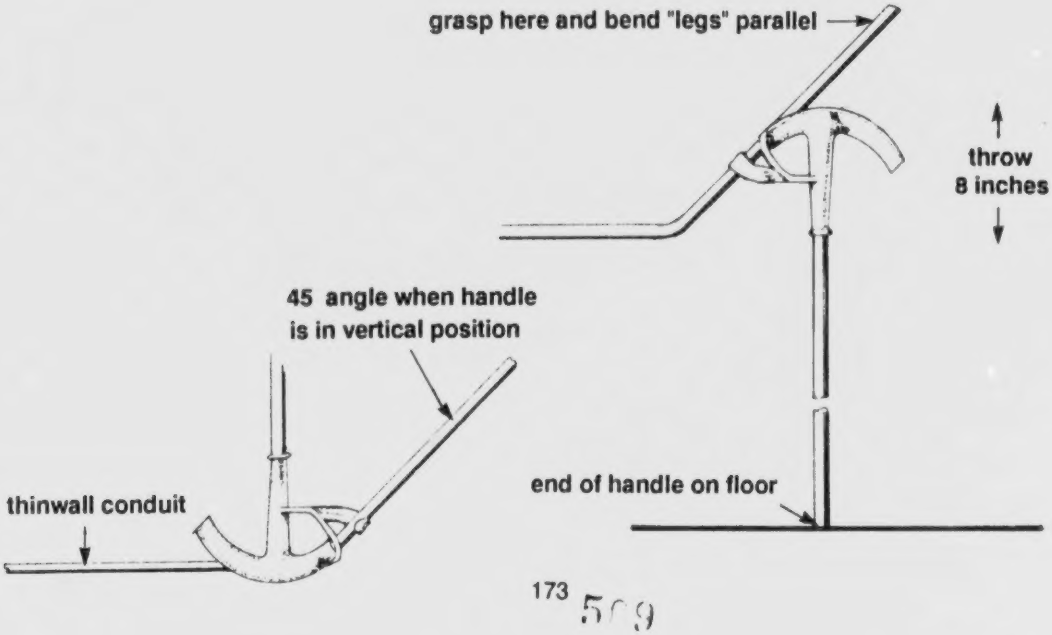
Other tools used for conduit and pipe which will not be shown here are taps and dies, bench or hydraulic benders, wrenches, pipe vises, etc.

CONDUIT BENDER



Hickey

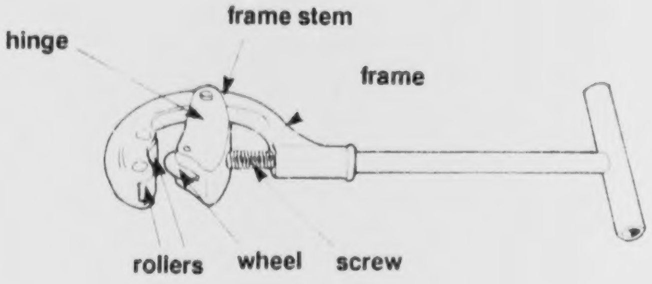
There are three types of hand hickeys (conduit benders), one for rigid conduit, one with a flanged socket for thin-wall conduit, and the one illustrated here is also the thin-wall conduit. This conduit bender is the type most commonly used.


grasp here and bend "legs" parallel
throw 8 inches
45 angle when handle is in vertical position
thinwall conduit
end of handle on floor

Bends are made by holding conduit in a fixed position and moving the hickey; also, bends are made by holding the hickey in a fixed position and shaping the conduit to the hickey.

Any type bend can be made such as an offset, saddle, right-angle, etc.

PIPE CUTTER



The pipe cutter illustrated here is of the wheel and roller hinged type. Most pipe cutters have a hook shaped frame on whose stem either a hinge or slide is moved by a screw. Rollers and wheel may be mounted on the frame or on the movable part. The wheel is forced into the pipe as the tool is rotated around the pipe.

The pipe cutter as illustrated can be converted to a three-wheel cutter by replacing the rollers with cutter wheels.

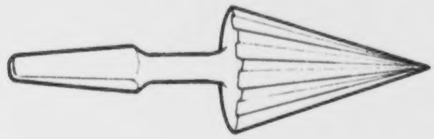
Pipe is cut quicker and with more accuracy than with a hacksaw, even though the hacksaw leaves less burr. Therefore, for the sake of speed and accuracy the pipe cutter is used for most jobs.

Three-wheel cutter:

1. Somewhat more difficult to start than wheel and roller cutter to make sure the cut is straight.
2. It leaves more of an outside burr. Burr must be filed off before attempting to thread the pipe.
3. Has the advantage of being able to cut a pipe in a close place. Handle need move only 120 degrees in order to part the pipe.

Cutter wheels are easily removed and replaced when they become dull or nicked.

PIPE REAMER



Different types of tapered reamers are available. Their primary use is to remove burrs from the inside diameter of a pipe; however, they can be used for countersinking and enlarging holes in sheetmetal.

Some are adaptable for use in a brace, others with a ratchet, and some with an electric drill.

Burrs must be removed from pipe and conduit because:

1. Inside burrs make it difficult to pull circuit wires.
2. Outside burrs make it difficult to thread pipe or conduit.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ____________________

UNIT:	Tools, Equipment, and Materials for Electrical Trades
TOPIC:	Learning About Conduit and Pipe Tools
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate an understanding of the conduit and pipe tools used in electrical trades.
REFERENCE:	Student Information Sheet/Learning About Conduit and Pipe Tools
DIRECTIONS:	Below are questions that are to be answered in complete sentences and in as few words as possible. The assignment is designed to include correct spelling and the use of correct trade terms.

1. What are two ways that a conduit bender is used to shape and form conduit bends?

2. What are the type bends made with a hickey?

3. What are two disadvantages of a three-wheel pipe cutter?

4. What is an advantage of the three-wheel pipe cutter?

5. Why use a pipe cutter as opposed to a hacksaw?

6. What causes the pipe cutter to part pipe?

7. Why remove burrs from pipe or conduit?

8. What are the uses for a pipe reamer?

9. What is the shape of a pipe reamer?

10. What are the ways in which pipe reamers are adaptable for use?

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**____________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

NAME OF JOB: Learning About Conduit and Pipe Tools

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to use a conduit or pipe tool.

TOOLS AND EQUIPMENT: Display of conduit and pipe tools prepared by instructor.

MATERIALS: Used conduit, pipe, etc.

GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

1. Select one tool from the display.
2. Using proper safety procedures, demonstrate how the tool should be used.
3. Replace the tool.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

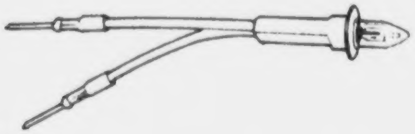
TOPIC: Learning About Test Lights and Wood Chisels

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be familiar with the use of test lights and wood chisels in electrical trades.

TEST LIGHT

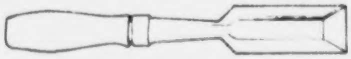
This electrician tool is used to determine if a circuit is hot. It may also be referred to as a neon tester.



Any circuit that is about to be worked on must be considered a live one. This is when the test light is used as a safety device to prove to one's self the status of a circuit.

The probes are inserted into a receptacle to see whether or not electricity is present. Some receptacles are split wired on separate circuits; therefore, test both receptacles. If power is present remove fuses or flip circuit breakers to the off position until the light goes out.

WOOD CHISEL



The wood chisel is used to notch out wood framing structure or to remove small wood obstructions.

Wood chisels are made of tough alloy steel blades with precision-ground bevels and cutting edges. They are of a one-piece blade and tang. Handles are usually made of plastic with a rounded steel end cap for hammering.

Blades are manufactured in widths of 1/4" to 1 1/2". Overall length varies from 7 1/4" to 8 1/4".

This tool should be kept sharp and ready for use. When using this tool, care should be taken not to strike nails or other metal objects with the cutting edge.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ____________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: Learning About Test Lights and Wood Chisels

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of the use of test lights and wood chisels in electrical trades.

REFERENCE: Student Information Sheet/Learning About Test Lights and Wood Chisels

DIRECTIONS: Read each of the following statements. If the statement is true, circle the T, if false, circle the F.

1. The test light is used to determine if a circuit is hot. T F
2. Any circuit that is to be worked on must be considered a live one. T F
3. The test light is tested by inserting the probes into any circuit to make sure the light will burn. T F
4. The wood chisel is used to notch out wood framing structure or to remove small wood obstructions. T F
5. Wood chisels are made up of a two piece blade and tang. T F
6. Wood chisels are made of tough alloy steel blades with precision-ground bevels and cutting edges. T F
7. Chisel handles are usually made of plastic with a flat steel end cap for hammering. T F
8. Some receptacles are split wired on separate circuits; therefore, the test light should be used to test both receptacles. T F
9. Chisels should be kept sharp and ready for use. T F
10. Chisels may be used to cut through nails or other metal objects. T F

JOB SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

NAME OF JOB: Learning About Test Lights and Wood Chisels

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to use a test light or wood chisel.

TOOLS AND EQUIPMENT: Display of test lights and wood chisels prepared by instructor.

MATERIALS: Light sockets, switches, boards, etc.

GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

1. Select one tool from the display.
2. Using proper safety procedures, demonstrate how the tool should be used.
3. Replace the tool.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: What Materials Are Used By Electricians

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

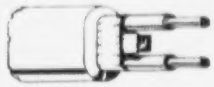
SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be familiar with the materials used by electricians.

Just as there are many tools used by electricians, there are also many different kinds of materials used. By studying the materials shown below you learn to recognize many of the materials you will encounter if you choose to work in the residential electrician trade.

ELECTRICAL MATERIALS

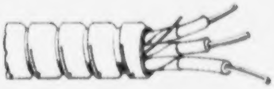
I. Types of Wire Conductors

A. Nonmetallic cable (NM)



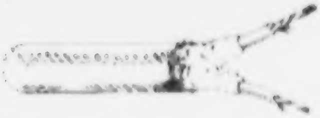
B. Thermal wire cable (TW)

C. Metallic armored cable (BX)



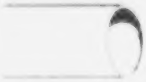
D. Lamp cord (rubber or braided insulation)

E. Power service cord (SJ)

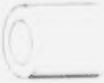


II. Types of Conduit

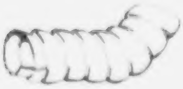
A. Thinwall (EMT) Electrical Metallic Tubbing



B. Rigid

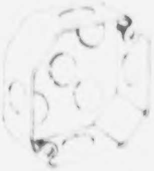


C. Flexible

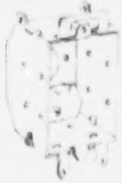


III. Types of Electrical Boxes (made of plastic or metal. These boxes are used for splicing non-metallic cable as in junction boxes and for attaching switches, receptacles, and light fixtures.

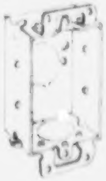
A. Octagonal ceiling or junction



B. Rectangular wall switch or outlet



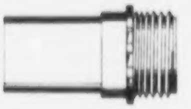
C. Shallow



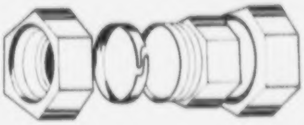
V. Types of Electrical Connectors

A. Conduit connectors

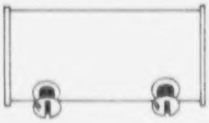
1. Indenter type



2. Compression type

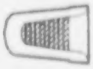


3. Coupler

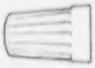


B. Conductor connectors

1. Wire nuts



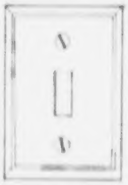
2. MN wire connector



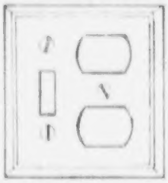
VI. Types of Electrical Covers (Plastic or Metal) Used to safely cover switch and receptacle connections.

A. Duplex receptacle

B. Switch Cover

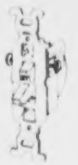


C. Combination duplex and switch

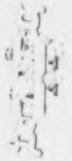


VII. Types of Switches--used to open and close circuits

A. Single pole

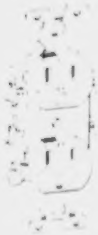


B. Three-way



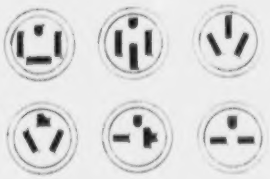
VIII. Types of Outlets and Receptacles

A. Duplex with ground

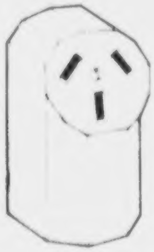


(NOTE: duplex without a ground is not approved for use.)

B. 208-240V



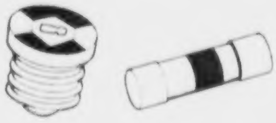
C. Surface mount 24V



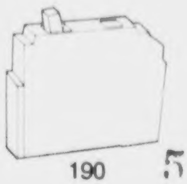
D. Weatherproof

IX. Types of Electrical Safety Devices

A. Fuses



B. Circuit breaker



ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ________________________ **DATE:** ____________________

UNIT: Tools, Equipment, and Materials for Electrical Trades

TOPIC: What Materials Are Used by Electricians

UNIT OBJECTIVE: After completing this unit of instruction, the student will be familiar with the use of tools, equipment, and materials in electrical trades.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will identify materials used by electricians.

REFERENCE: Student Information Sheet/What Materials Are Used By Electricians

DIRECTIONS: Your instructor will make a display of materials listed on Student Information Sheet/What Materials Are Used By Electricians. Each type of material will be assigned a number. On a sheet of paper write the correct name for each type of material beside the number.

UNIT V

THEORY OF ELECTRICITY

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Theory of Electricity

TOPIC: Basic Electrical Circuits

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate a basic understanding of the theory of electricity.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to demonstrate an understanding of basic electric theory.

When working in electrical trades it is important that you understand how electrical circuits function and the basic laws that govern them. The word **electricity** is commonly used to mean the flow of electrons through a conductor, or the flow of current. There are two different types of current. One type **direct current (DC)** always flows in a continuous path in the same direction. The other type is called **alternating current (AC)** because the flow of current changes direction at regular intervals.

DIRECT CURRENT (DC)

In a direct current,according to the modern electron-flow theory, the flow of current is from a negative terminal to a positive terminal. In figure 1, a battery is used as the source of direct current. The symbol of a battery, as shown, has a short line representing the negative terminal and a long line at the bottom representing the positive terminal. The term load is used to represent any electrical device that will perform a task when the current is allowed to flow through it. You can tell by the direction of the arrows that as long as there is no break in the wire conductor (that is, the circuit is not "open") the current will flow continuously from the negative to the positive terminal. The advantage of direct current is that it provides a consistent level of current because it does not lose efficiency due to a change in direction. Since alternating current continuously changes directions, a continuously changing magnetic field is created, which leads to inefficiency.

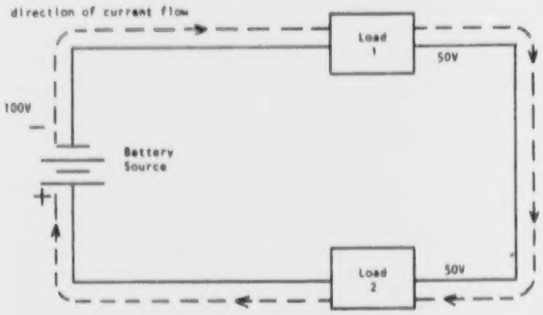


Figure 1. DC series circuit

ALTERNATING CURRENT (AC)

Certain disadvantages of direct current are overcome by the use of alternating current. When current must be moved a long distance--for example, from a large generating plant to various sections of large cities--it is more economical to use alternating current. For such a large network of electrical distribution, transformers must be used to step down and step up the levels of current and voltage that are needed. This is not possible with direct current. If direct current were fed into a transformer, no output current would be produced because direct current is continuous and constant in one direction only and transformers require changes in current directions to effect a change in voltage.

The most common form of alternating current used in the United States is 60 cycles per second current, or 60 hertz (Hz), which means that the current travels from the AC power plant to the electrical consumer and back to the power plant 60 times in one second. In other words, it changes direction 120 times in one second. Figure 2 depicts this as an AC sine-wave curve.

The AC graphical representation in figure 2 is for the common 110-volt (V) household current. As the AC current leaves the AC generator at the power plant, the **voltage**--the force causing the current to move through conductive wires--climbs from zero potential to a peak of 110 V during the positive half cycle. This happens in the first quarter of the cycle. In the second quarter of a cycle, the voltage gradually decreases to zero potential. It then changes (goes negative) direction to begin the third quarter of the cycle. It gradually increases in value until it reaches the maximum or peak value of 110 V negative. In the last quarter of the cycle, the negative voltage gradually decreases, until it returns to zero potential and is ready to change direction and start a new cycle. Remember that it completes 60 of these complete cycles in one second. Whichever direction the current is going, whether it is the positive half cycle or the negative half cycle, it is providing electrical energy for use.

A DC voltage of 110 V will remain a constant value. There are no fluctuations once the switch is turned on from a DC electrical appliance. The voltage jumps instantly to 110 V and remains at the value until the switch is turned off, breaking the circuit. You can easily see why DC voltages are more efficient than AC voltages.

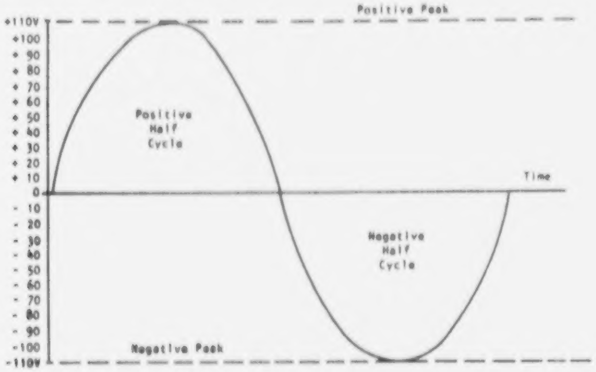


Figure 2. AC-voltage sine wave

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Theory of Electricity

TOPIC: Basic Electrical Circuits

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate a basic understanding of the theory of electricity.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of basic electric theory.

REFERENCE: Student Information Sheet/Basic Electrical Circuits

DIRECTIONS: Read and answer each of the following questions in the space provided.

1. How many times does alternating current change in one second?

2. What is the advantage of using direct current instead of alternating current?

3. How is direct current different from alternating current?

4. What is the force that causes the current to move through the conductive wires?

5. What is the advantage of using alternating current instead of direct current?

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Theory of Electricity

TOPIC: Fundamentals of Electricity

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate a basic understanding of the theory of electricity.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to:

1. explain what the valence shell is;
2. explain why better conductors have only one electron in their valence shells;
3. explain the relationship of the conductor movement in the magnetic field to the ability of the conductor to induce a current; and
4. explain the relationship of the magnetic field's polarity to that of the induced current.

THE ELECTRON THEORY

An atom is the smallest part of an element that can take part in ordinary chemical changes. However, an atom is composed of many particles. Electrons, protons, and neutrons are the particles of primary interest here. Any atom has a **nucleus** around which one or more electrons revolve. Figure 1A shows the atomic structure of the simplest of all atoms, the hydrogen atom. It has one electron revolving around one proton that acts as a nucleus. A helium atom is shown in figure 1B. Its nucleus consists of two protons and two neutrons, around which two electrons revolve.

Notice that the electrons are marked with a negative sign (-) and the protons with a positive sign (+). The neutrons of an atom do not have an electrical charge.

Because it is the smallest amount of electricity that exists, the charge on an electron is the elemental unit of electricity. However, this unit is much too small a quantity of electricity for practical purposes. Therefore, a much larger unit, called a **coulomb**, is used. One coulomb of electricity has over 6 million, million, million electrons.

Atoms of other elements are more complex than the hydrogen and helium atoms. Figure 2A represents the structure of the carbon atom. Notice that 6 orbital electrons revolve in two separate rings or shells around the nucleus of 6 protons and 6 neutrons. Figure 2B shows the atomic structure of an aluminum atom. Its nucleus has 13 protons and 14 neutrons, around which 13 electrons revolve in three separate rings or shells. Figure 2C shows a copper atom with a nucleus of 29 protons and 35 neutrons, around which revolve 29 electrons in four separate rings or shells.

The only difference between elements is in the number and arrangement of the electrons, protons, and neutrons of which each is composed. The electrons of an atom have a definite order in their arrangement. For example, shell number 1, the inner shell, can hold no more than 2 electrons. Shell number 2 can hold no more than 8 electrons. Shell number 3 can hold no more than 18 electrons. Shell number 4 and all other shells farther from the nucleus can hold no more than 32 electrons. However, the outer shell (called the **valence shell**) can never hold more than 8 electrons. The electrons in the outer shell are the ones of primary interest.

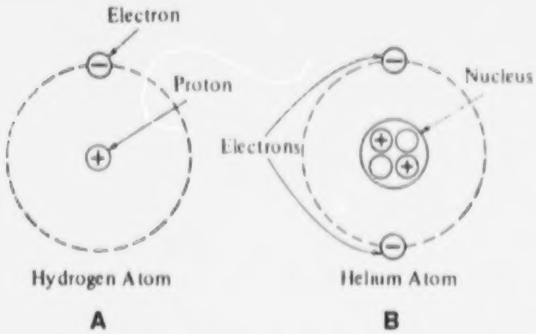

Electron
Proton
Electrons
Nucleus
Hydrogen Atom
Helium Atom
A
B

Figure 1. Hydrogen and helium atoms

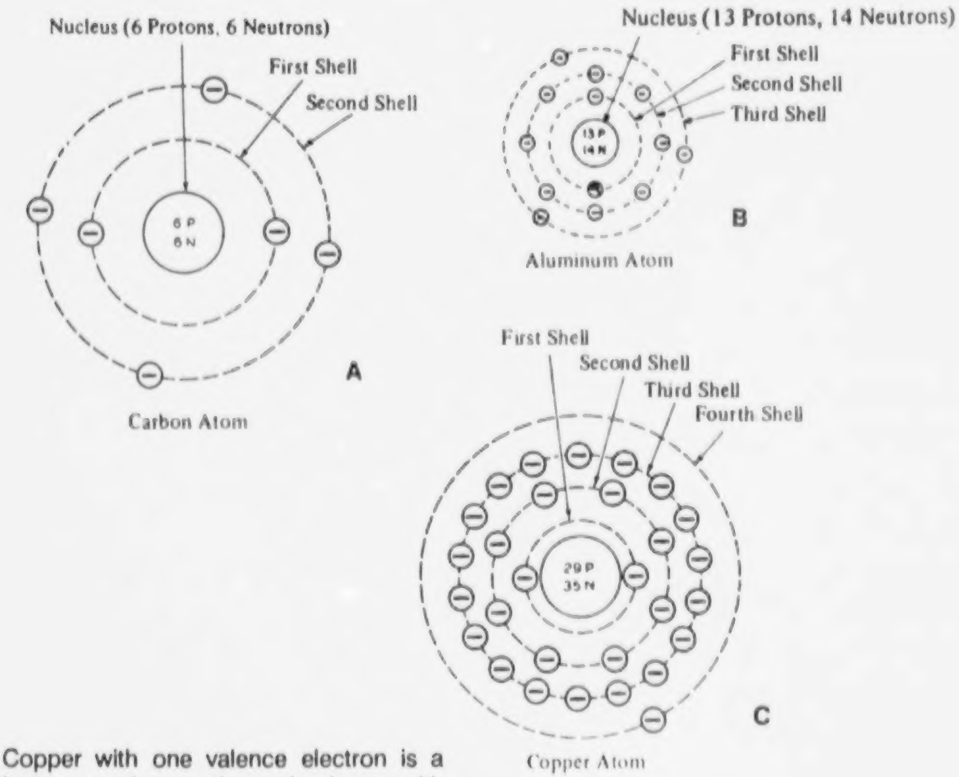

Nucleus (6 Protons, 6 Neutrons)
First Shell
Second Shell
6 P
6 N
A
Carbon Atom
Nucleus (13 Protons, 14 Neutrons)
First Shell
Second Shell
Third Shell
13 P
14 N
B
Aluminum Atom
First Shell
Second Shell
Third Shell
Fourth Shell
29 P
35 N
C
Copper Atom

Figure 2. Copper with one valence electron is a better conductor than aluminum with three or carbon with four.

The attracting (holding) force of the positive nucleus of an atom weakens with distance. For this reason, electrons revolving in the valence shell are easier to move out of their orbits than the ones in the inner (planetary) shells.

CONDUCTORS

If enough energy is added to the centrifugal force of an electron, the electron will leave its orbit and move into a higher orbit. Since a valence electron has no higher orbit, it will be freed from its atom and will move into another atom. The energy applied to the valence shell of an atom is distributed amount the electrons in the shell. For this reason, elements that have only one valence electron are the best electrical conductors because less energy is required to move the electron out of its orbit. Gold, silver, and copper atoms each have only one valence electron. Gold is the best conductor because a gold atom has six shell. This puts its valence electron farther from the nucleus. Cooper, with its four shells, ranks behind gold and silver. However, it is used most because it is less expensive.

Aluminum is not a good conductor because an aluminum atom has three valence electrons. Nevertheless, it is used as a conductor where weight is a major consideration, such as with cross-country, high-tension lines with long spans between supports. Usually these are stranded cables with a small steel wire core to provide the tensile strength.

The ability of a conductor to conduct electricity depends also on it dimension. In other words, it depends on the width of its cross section. More atoms are present in a large cross section. Therefore, more free electrons are available. Conductors may be in the form of bars, tubes, sheets, or wires. Many sizes of wire are used. They range from fine hairlike wire to large cables. Stranded wire is used when flexibility is necessary.

INSULATORS

Electrical conductors must be protected and isolated by materials called insulators. Glass, air, rubber, and certain plastics are insulators.

The atoms of stable elements have eight electrons in their valence shell. Such an atom will not combine with other atoms to form compounds. Such elements are neon, argon, helium, and radon. Atoms that have fewer than eight electrons in their valence shell are less than half filled, an atom tends to empty its valence shell by giving up its valence electrons. This makes it a conductor. If the valence shell is more than half filled, an atom tends to fill its valence shell by collecting electrons. Materials to these kinds of atoms are classified as insulators. For instance, an oxygen atom is a good insulator because it has six valence electrons (fig. 3). It tends to fill its valence shell by collecting electrons from atoms that tend to empty their valence shells. Since a hydrogen atom has one valence electron (fig. 4), it tends to empty its valence shell. When a hydrogen atom is close enough, it will share its valence electron with an oxygen atom. Since the oxygen atom needs two electrons to fill the valence shell, two hydrogen atoms can share their valence electrons with one oxygen atom (fig. 5). When this occurs, one molecule of pure water is formed. Since the valence shell of the oxygen atom is filled, water is a good insulator. (Impurities in water may be excellent conductors, however.)

CURRENT

The force that causes electrons to flow through a conductor is called **electromotive force** (emf). This force is a result of an imbalance of positive protons and negative electrons. This imbalance of electrons is called a **difference in potential**. When a conductor connects a material with an excess of negative electrons to another material with a deficiency of electrons, the excess electrons will flow through the conductor to the materials with a deficiency of electrons.

Although there are six methods of producing a difference in potential, only two of them will be discussed here.

The first type is a battery known as a **voltaic cell**. It creates a difference in potential chemically. Two dissimilar metals are used along with sulfuric acid (fig. 6). If a small sheet of zinc is suspended in

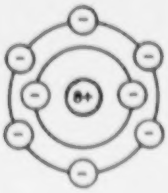


Figure 3. An oxygen atom, with six valence electrons, tends to collect electrons from other atoms.

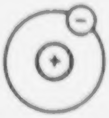


Figure 4. A hydrogen atom, with one valence electron, tends to give it up to other atoms.

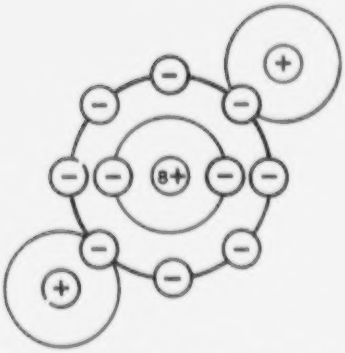


Figure 5. Two hydrogen atoms share their valence electrons with an oxygen atom to form pure water (H20).

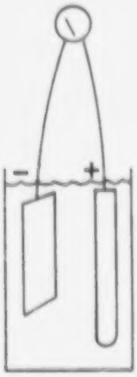


Figure 6. Negative ions (electrons) flow from the zinc through the conductor to the copper

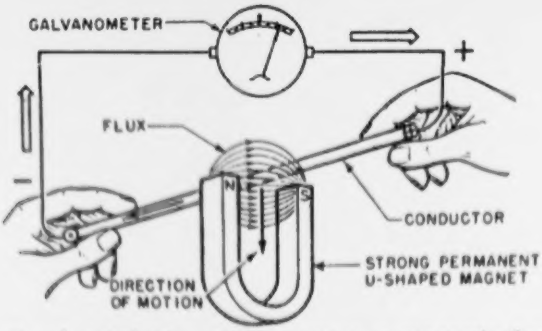


Figure 7. A conductor cutting across a magnetic flux field induces a current in the conductor.

a solution of sulfuric acid and water, a chemical reaction takes place. The reaction causes the zinc to become unbalanced with an excess of electrons. Electrons, remember, are negative. If a copper rod is suspended in the same solution, it will become positive. That is, it will have a deficiency of electrons. The copper will have more positive protons than negative electrons. A difference in potential has been created.

If a conductor were to be connected to both metals, the electromotive force, or difference in potential, would cause the electrons to move from the zinc plate through the conductor to the copper rod. This flow of electrons is an **electric current**. This current will continue as long as a chemical reaction takes place.

Another way of developing a difference in potential is through the use of a magnetic force. If a conductor is moved through a magnetic field so that the conductor cuts across the magnetic lines of flux, a momentary voltage will be induced in the conductor. This induced voltage will cause current (electrons) to flow through the conductor.

This can be checked by connecting a current-measuring device called a galvanometer to each end of the conductor (fig. 7). When the conductor is moved through the flux in a downward motion, the galvanometer needle will be momentarily deflected. This indicates that a voltage has been induced in the conductor. This current is called **induced current**.

If the conductor is held stationary in the magnetic field, the galvanometer needle will indicate zero because no voltage is being induced in the conductor.

If the conductor is moved upward through the magnetic field, the needle will again be deflected. However, it will be deflected in the opposite direction to that when the conductor was moved downward. This indicates that the polarity of the induced voltage has been reversed. This reverses the direction of the induced current through the galvanometer.

If the conductor is moved in the field in a sideways direction, from the north pole to the south pole or vice versa, so that no lines are cut, the galvanometer needle will remain at zero. This again indicates that no voltage is being induced in the conductor. As the angle between the flux lines and the path of the conductor is increased, the deflection of the galvanometer needle increases until maximum deflection is obtained. Maximum deflection occurs when the conductor is swept through the magnetic field at right angles to it.

If the polarity of the magnetic field is changed, the polarity of the induced voltage will be reversed also.

LEFT-HAND GENERATOR RULE

The relationship between the motion of the conductor, the magnetic flux it cuts, and the direction of the induced current is summed up by the left-hand generator rule (fig. 8). With the thumb, forefinger, and the middle finger of the left hand set perpendicularly to each other as shown, point the forefinger in the direction of the flux and the thumb in the direction of motion of the conductor. The middle finger will then point in the direction in which the generator or induced voltage tends to send the current through the circuit.

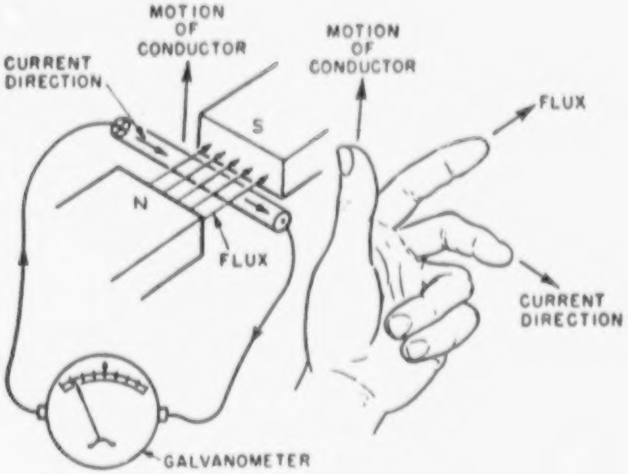

MOTION OF CONDUCTOR
CURRENT DIRECTION
S
N
FLUX
MOTION OF CONDUCTOR
FLUX
CURRENT DIRECTION
GALVANOMETER

Figure 8. Left-hand generator rule

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Theory of Electricity

TOPIC: Fundamentals of Electricity

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate a basic understanding of the theory of electricity.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of the fundamentals of electricity.

REFERENCE: Student Information Sheet/Fundamentals of Electricity

DIRECTIONS: Read and then answer each of the following questions in the space provided.

1. Define an atom.

2. What does an atom consist of?

3. Which particles of an atom are negative, and which are positive?

4. What is the only difference between elements?

5. What is the outer electron shell called?

6. Why are valence electrons easier to move out of their shell than other electrons?

7. Why are elements that have only one valence electron the best conductors?

8. Why is gold a better conductor than copper?

9. Why is aluminum not a good conductor?

10. When is aluminum used as a conductor?

11. Why does a large cross section make a material a better conductor than a small cross section?

12. Why are some conductors made in strands?

13. What makes an atom stable?

14. What is the tendency of an atom that has less than half of the valence shell filled?

15. What is the tendency of an atom that has more than half of the valence shell filled?

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Theory of Electricity

TOPIC: Generating Electrical Current

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate a basic understanding of the theory of electricity.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to:

1. explain how an electromagnet is made;
2. explain how to increase the induced voltage;
3. explain the quarter cycles of a generator; and
4. name the phase system of power used in the United States.

While a magnetic bar is sufficient for laboratory work in proving that electrical voltage is indeed induced in a conductor cutting across a magnetic flux, it is not practical in generating large amounts of electricity. The size of the magnet would make it unwieldly as well as impractical. For this reason, a smaller but more powerful electromagnet is used.

An electromagnet is a magnet made by wrapping an electrical conductor around an iron core (fig. 1). The strength of intensity of the magnetic field around a current-carrying conductor increases when the current increases, and decreases when the current decreases. Also, the direction of the magnetic field around a current-carrying conductor depends on the direction of the current through the conductor. Reversing the direction of current in the conductor reverses the direction of the magnetic field. The direction of the magnetic field is always at a right angle to the electric field. The left-hand rule also applies to determining the direction of the magnetic field. If the conductor is grasped in the left hand with the thumb pointing in the direction of electron flow, the fingers will point in the direction of the magnetic field (fig. 2).

FACTORS DETERMINING MAGNITUDE OF INDUCED VOLTAGE

Three factors determine the magnitude (strength) of the induced voltage. The first factor is the number of turns in the conductor. A turn is a loop. In figure 3, only one loop of wire is used. If two loops of wire are used, the motion of the magnet through the loops of wire will cause twice the deflection on the galvanometer that one turn will cause, everything else remaining equal. If more loops or turns of wire are added (fig. 4), the motion of the magnet will further increase the deflection of the galvanometer. It is apparent that **increasing the number of turns increases the induced voltage**.

The second factor in increasing the induced voltage is to increase the strength of the magnetic field. This can be done by using a winding around the magnet and making it an electromagnet with a greatly increased field strength (fig.5). Cutting this magnetic field with a conductor increases the induced voltage. **Increasing the field strength increases the induced voltage.**

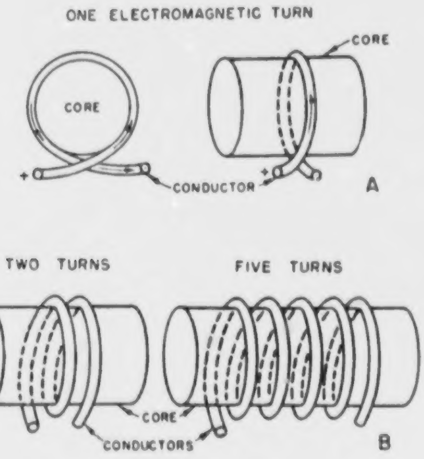

ONE ELECTROMAGNETIC TURN
CORE
CORE
+
+
CONDUCTOR
A
TWO TURNS
FIVE TURNS
CORE
CONDUCTORS
B

Figure 1. Electromagnet

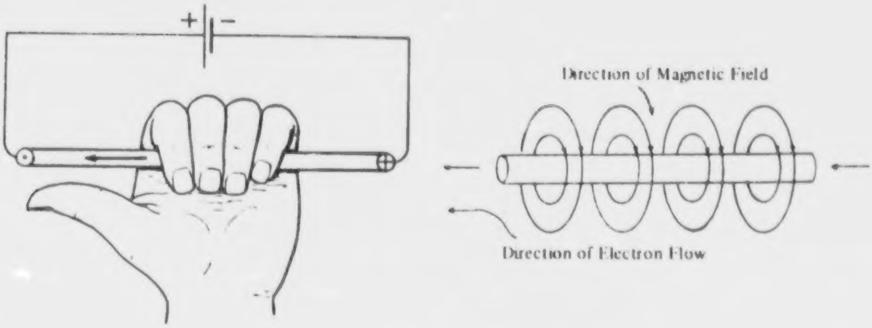

+
−
Direction of Magnetic Field
Direction of Electron Flow

Figure 2. Left-hand rule for deterrmining the direction of the magnetic field

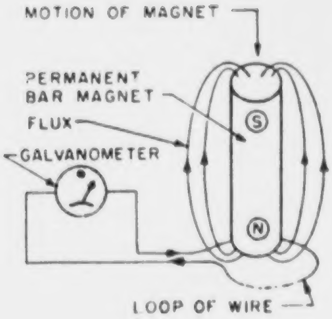

MOTION OF MAGNET
PERMANENT BAR MAGNET
FLUX
GALVANOMETER
S
N
LOOP OF WIRE

Figure 3. Inducing an electromotive force in a loop

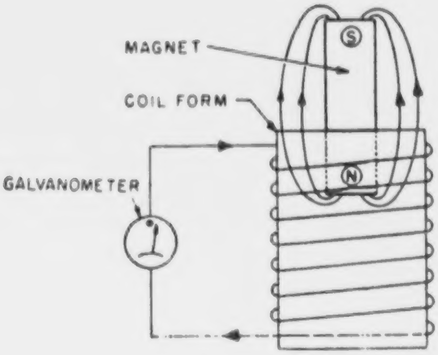

MAGNET
S
COIL FORM
GALVANOMETER
N

Figure 4. Inducing an electromotive force in a coil

The third factor that determines the magnitude of the induced voltage is the speed of the conductor as it cuts across the magnetic field. If the conductor is passed through the magnetic field first slowly and then rapidly, you will notice that a much greater voltage is induced when the conductor is moved rapidly. **Increasing the speed of the conductor through the magnetic field increases the induced voltage**.

Summing up, whenever there is a relative motion between a conductor and a magnetic field, the magnitude of the voltage induced in the conductor is directly proportional to (1) the number of turns in the conductor. (2) the strength of the magnetic field, and (3) the speed of the relative motion between the conductor and the magnetic field.

A SINGLE-PHASE GENERATOR

Figure 6 is a simplified diagram of a generator. A magnetic field is established between north and south poles by means of an "exciting" current flowing in winding W. A loop of wire I in this field is arranged so that it can be rotated on the axis C. The ends of this loop are brought to slip rings SS on which brushes BB can slide. The circuit of which this rotating loop is a part is completed through the slip rings at A. When this loop is rotating, the conductors D and E have a voltage produced in them that will cause a current to flow out to A where the circuit is completed.

Figure 7 shows a series of diagrams still more simplified in which the magnetic field is merely indicated. The loop of wire is assumed to be rotating with a uniform speed in the direction shown by the curved arrows. If you now consider only the conductor marked with a spot, you see that at "start" the voltage will be zero because the conductor is moving parallel to the magnetic field.

Gradually, as it revolves, it begins to cut more and more across the magnetic field until a quarter of a revolution later, at "1/4 cycle," it is cutting squarely across the magnetic lines of flux. At this point, the voltage in the conductor will be a maximum. It will again reduce as the loop revolves to the "1/2 cycle," where it is zero because it will be moving parallel to the lines of flux. Then the voltage will rise in the opposite direction as the loop moves to the "3/4 cycle," where a maximum is reached again. The voltage drops again until it reaches the starting point at which the voltage will again be zero. Thus, as the conductor passes under a pair of north and south poles, a cycle of voltages takes place, first in one direction and then in the opposite direction. The unmarked conductor forming the opposite side of the loop always has a voltage of opposite polarity produced as it passes under the pole. The voltages in these two conductors always add together, and the voltage across the entire loop is equal to their sum.

Figure 8 shows these changes in voltage graphically. The curved line represents the voltage at any instant by its vertical distance above or below the horizontal axis line. At the start, the voltage is zero, when both conductors are moving parallel to the lines of flux. Then the voltage rises to a positive maximum as the conductors pass under the poles at "1/4 cycle." It falls to zero as it reaches the "1/2 cycle." The voltage rises again, but to a negative maximum, as the conductors reach the "3/4 cycle." It falls to zero again as it returns to the starting point.

The current in this circuit rises and falls with the voltage. It flows alternately first one direction and then the opposite--hence the name **alternating current**. Alternating current is defined as a current that is constantly changing in magnitude and periodically changing direction. The generator shown in figures 6 and 7 is a two-pole, single-phase, revolving-armature, alternating-current generator. The magnetic field, the coils of wire, and the iron core are called the "field" of the generator. The rotating loop in which the voltage is produced is called the "armature."

If the voltage completes 60 cycles in one second, it is called a "60-cycle" voltage. The voltage will cause a 60-cycle current to flow. A 60-cycle current is standard in the United States.

A TWO-PHASE GENERATOR

A two-phase generator is really a combination of two single-phase generators. Figure 9 (top) is a diagram of two single-phase generators or "alternators," which is the term applied to an alternating-current generator. The armatures of these machines are mounted on one long shaft and must revolve together, always at right angles to each other. When phase 1 is in such a position that the voltage in it is a maximum, phase 2 is in such a position that the voltage in it is zero. A quarter of a cycle later, phase 1 will be zero, and phase 2 will have advanced to the position formerly occupied by 1, and its voltage will be at a maximum. Thus, phase 2 follows phase 1, and the voltage is always just a quarter of a cycle behind because of the relative mechanical position of the armatures. Figure 9 (bottom) is a diagram of the relation of these voltages. It will be seen that phase 2 repeats all the alternations of phase 1 a quarter of a cycle later.

Figure 10 shows how these two alternators are put together and rotate through the same magnetic field on the same shaft. This makes a two-phase alternator since each external circuit is separate just as though there were two alternators.

A THREE-PHASE ALTERNATOR

A three-phase alternator has three single-phase windings that are combined on a single shaft and that rotate in the same magnetic field (fig. 11). Each end of each winding can be brought out to a slip ring and an external circuit. The voltage in each phase alternates exactly one-third of a cycle after the one ahead of it. This is due to the mechanical arrangement of the machine.

When the voltage in phase 1 is approaching a positive maximum, (fig. 12), the voltage in phase 2 is at a negative maximum, and the voltage in phase 3 is falling. The variations of these voltages are shown in figure 12.

As a rule, each end of each phase winding is not brought out to a separate slip ring in a three-phase alternator. The three phases are all connected together, as shown in figure 13. This makes only three leads necessary for a three-phase winding. Each lead serves two phases. Then each pair of wires acts like a single-phase circuit, substantially independent of the other phases. Power is generally produced and transmitted in three-phase systems.

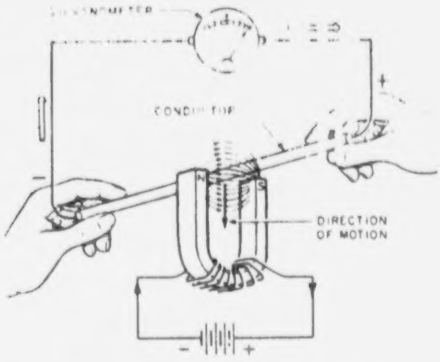

GALVANOMETER
CONDUCTOR
N
S
DIRECTION OF MOTION
+
−

Figure 5. Increasing the field strength increases the induced voltage

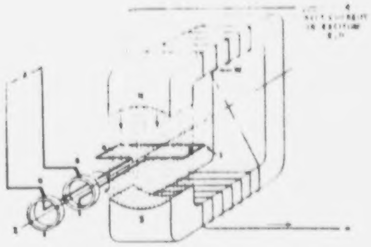


Figure 6. A simple electric generator using an electromagnet

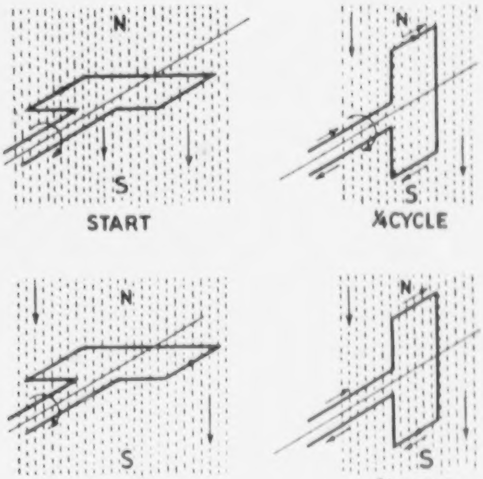

N
S
START
N
S
¼CYCLE
N
S
½CYCLE
N
S
¾CYCLE

Figure 7. One complete cycle of a loop illustrated in 1/4 cycles

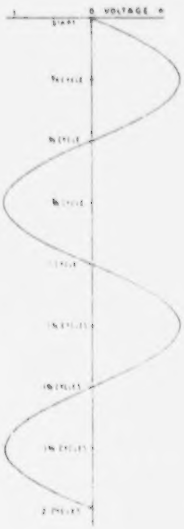


Figure 8. The curve represents the variations in voltage in the loop as it makes two revolutions in the magnetic field.

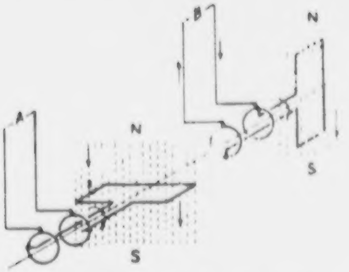
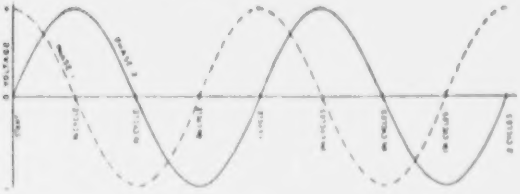


Figure 9. Top: Diagram of two simple generators; Bottom: curves represent the voltage in two separate loops rotating at 90 degrees to each other.



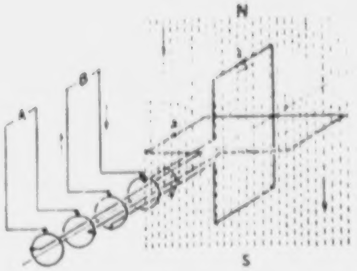


Figure 10. Both loops combined in a single machine rotating in a single magnetic field

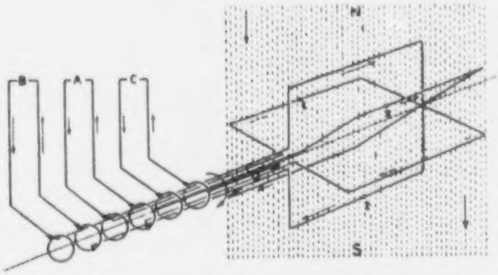


Figure 11. Three loops - three simple armatures revolving in the same magnetic field

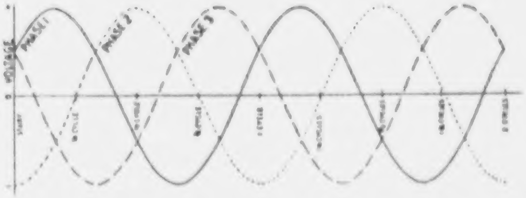


Figure 12. Voltage variations of a three-phase alternator

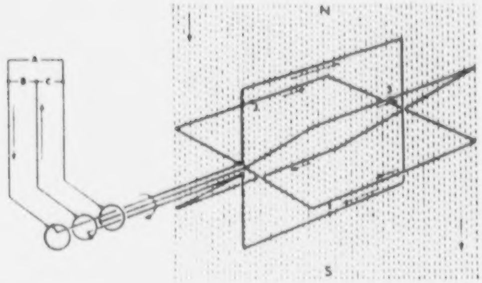


Figure 13. If three loops are connected together, within the machine, only three slip rings are needed.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT:	Theory of Electricity
TOPIC:	Generating Electrical Current
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate a basic understanding of the theory of electricity.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate an understanding of how electrical current is generated.
REFERENCE:	Student Information Sheet/Generating Electrical Current
DIRECTIONS:	Read and then answer each of the following questions in the space provided.

1. How is an electromagnet made?

2. How does the strength of the magnetic field affect the amount of current induced into the conductor?

3. What determines the direction of the magnetic field?

4. How does increasing the number of turns (loops) in an electromagnet affect the induced voltage?

5. How does increasing the strength of the magnetic field affect the induced voltage?

6. How does the speed with which the conductor cuts across the magnetic field affect the induced voltage?

7. At what point in its rotation through the magnetic field is a voltage not induced in the conductor?

8. At what point in its rotation through the magnetic field is the voltage induced in the conductor the greatest?

9. What is the difference between the voltage induced at the "1/4 cycle" and at the "3/4 cycle"?

10. What is the relationship of the polarity of the voltage induced in each side of the conductor loop to each other?

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Theory of Electricity

TOPIC: Units of Electrical Measurements

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate a basic understanding of the theory of electricity.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to:

1. name the various units of electrical measurement;
2. list the three factors in Ohm's law; and
3. use Ohm's law to determine voltage, amperage, and resistance.

The quantity of electron flow is measured in **coulombs**. A coulomb is 6.28 X 10^{18} electrons, or 6,280,000,000,000,000,000 electrons. The rate, or **intensity**, of current flow is measured in **amperes** (amp). An ampere is one coulomb per second. As electrons flow from one atom to another, they encounter opposition because of the atomic structure of the material. This opposition is called **resistance**, which is measured in a unit called an **ohm**. An ohm is the amount of resistance that will permit one volt to push one ampere. The ability to conduct electricity, called conductance or **ampacity**, is exactly opposite to resistance. The unit of measurement is the **mho**, which is ohm spelled backwards. If the cross-sectional area of a conductor is twice that of another conductor, the larger conductor has a greater ability to conduct electricity. The reason is that it has a greater number of free electrons. In other words, the conductivity of the larger conductor is greater, and it has less resistance to electrical current flow. Stated another way, the smaller conductor offers more resistance to electrical current flow, and its conductivity is less.

Georg Simon Ohm found that the ratio of voltage and current for any type of conductor is a constant. The material of which the conductor is made and its physical dimension determine the constant value. The results of experiments made by Ohm are called **Ohm's law**. The three factors in Ohm's law are:

E = electromotive force or voltage applied across the conductor

I = intensity of current flow or amperes through the conductor

R = **resistance** (in ohms) of the conductor, depending on the material of which the conductor is made, its physical dimensions (length and cross-sectional area), and temperature. Ohm's law can be written in the following forms:

E = I X R

$I = E/R$

$R = E/I$

EXAMPLES

(1) Assume that 100 volts are applied to a circuit in which the resistance to current flow is 100 ohms. Find the current flow in amperes.

$$\text{current} = \frac{\text{voltage}}{\text{resistance}}$$

or

$$\text{amperes} = \frac{\text{volts}}{\text{ohms}}$$

or

$$I = \frac{E}{R} = \frac{100}{10} = 10 \text{ amp}$$

(2) If the voltage and current are known, the circuit resistance may be found in the same manner. Using the same circuit values, find the resistance in ohms to current flow.

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

or

$$\text{ohms} = \frac{\text{volts}}{\text{amperes}}$$

or

$$R = \frac{E}{I} = \frac{100}{10} = 10 \text{ ohms}$$

(3) The voltage can be found by multiplying the circuit resistance by the current flow.

$E = I \times R = 10 \times 10 = 100$ volts.

An easy way to memorize Ohm's law is shown in figure 1. When two quantities are known, the third can be found by placing the finger over the unknown quantity in the circle and solving according to their positions in the circle. For example, to find amperes, put your finger over I in the circle, and read E/R. Divide E by R. To find volts, place your finger over E, and read I x R. Multiply I times R. To find R, cover R with your finger and read E/I. Divide E by I. Thus, the three variations of Ohm's law are $E = IR$, $R = E/I$, and $I = E/R$.

Power is the rate at which work is done. The unit used to measure electric power is the **watt**. Electrical circuits are described in terms of voltage, amperage, and wattage. For this reason, it is necessary to form an equation that expresses the power in watts in terms of volts and amperes. The power expended in any circuit is the product of voltage and current flowing in that circuit. In other words, one watt of power is being expended between two points when one ampere of current flows between the points under the pressure of one volt. This is expressed in the following equations and illustrated in figure 2.

$P = I \times E$

I = P/E

E = P/I

P = power, in watts

I = intensity of current flow, in amperage

E = electromotive force, in volts

EXAMPLES

(1) If an electric motor requires 10 amperes at 110 volts, what is the power consumed?

$P = E \times I = 10 \times 100 = 1{,}100$ watts

(2) If a battery charger operates at 100 volts and consumes 600 watts, what must be the smallest fuse that will maintain the charger operations?

$I = P/E = 600/100 = 6$ ampere fuse

(3) What voltage will be measured at the terminals of a 500-watt generator when 10 amperes are being drawn?

$E = P/I = 500/10 = 50$ volts

The electrical power law is sometimes called **Watt's law**, and W is used to represent power in the formula instead of P. Notice that resistance was not considered in the power law. However, the values of resistance may be considered by using the formula, $P = E^2/R$. The following problem illustrates an application of the formula: What is the wattage rating of a 120-volt bulb that has a resistance of 144 ohms?

$P = E^2/R = 120 \times 120 / 144 = 14{,}400/144 = 100$ watts

By transposing, R can replace P in the formula so that the resistance of a circuit can be determined if the power and voltage are known. For example, a resistor radiates 20 watts of power in the form of heat when connected to a 20-volt dc source. What is the resistance value of the resistor?

$R = E^2/P = 20 = 20/20 = 400/20 = 20$ ohms

Another important formula can be developed by substituting the value of voltage (e) in Ohm's law (I X R) for the value of voltage in the power law.

$P = I \times E = I \times (I \times R) = I^2R$

The most common loss of power in electrical work is that which is dissipated in the form of heat when current flows through a resistance.

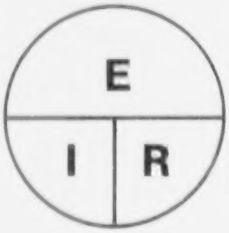


Figure 1. Ohm's law

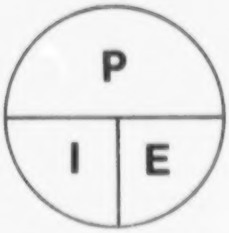


Figure 2. Power law

This power loss is sometimes called the I^2R loss, or copper loss. It is always present when current is flowing. The heat is usually dissipated into the air and lost. However, it can be utilized as in the case of the electric oven, toaster, and soldering iron. If 0.3 ampere of current flows through a 20-ohm resistor, what wattage is expended across the resistor?

$P = I^2R = 0.3 \times 0.3 \times 20 = 1.8$ watts

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Theory of Electricity

TOPIC: Units of Electrical Measurements

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate a basic understanding of the theory of electricity.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of units of electrical measurements.

REFERENCE: Student Information Sheet/Units of Electrical Measurements

DIRECTIONS: Read and then answer each of the following questions in the space provided.

1. What is a coulomb used for?

2. What does ampere measure?

3. What is an ampere?

4. What is used to measure resistance?

5. Define **one ohm.**

6. What is used to measure conductivity?

7. How does increasing the cross-sectional area of a conductor affect its ability to conduct electricity?

8. Why does an increased cross-sectional area increase the ability of a conductor to conduct electricity?

9. Name the three factors in Ohm's law.

10. List the three variations of Ohm's law.

UNIT VI

GENERATING AND DISTRIBUTING ELECTRICAL POWER

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT:	Generating and Distributing Electrical Power
TOPIC:	Generating Electricity
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate an understanding of the processes of generating and distributing electrical power and the role of the electric utility company.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will be familiar with how electricity is generated.

I. What is Electricity?

  A. Electricity is the flow of electrons along a conductor.

  B. There are several ways to produce electricity.

    1. Practical methods

    2. Exotic methods

II. Friction

  A. Electricity is produced when two materials are rubbed together.

  Example: Brushing your hair with a hairbrush can cause static electricity.

  B. Practical applications of static electricity

    1. Manufacture of sandpaper

    2. Cleaning polluted air

III. Pressure

  A. Electricity is produced when pressure is applied to a crystal.

    1. Rochelle salts

    2. Quartz

  B. Bending a crystal produces a small electrical output.

    1. This is known as the piezoelectrical effect.

    2. Crystal pickups are used in inexpensive record players.

IV. Heat

A. Electricity is produced when heat is applied to the junction of two dissimilar metals.

B. This is referred to as a thermocouple.

V. Light

A. Electricity is produced when light strikes a photosensitive material. (NOTE: The word photo means light.)

B. Photoelectric cells are used in cameras, spacecraft, and in radios.

VI. Chemical Action

A. Electricity is produced when a chemical action takes place between two metals in a cell.

B. A single unit is called a cell.

C. Connecting two or more cells together produces a battery.

D. Batteries are used in flashlights, radios, hearing aids, and in calculators.

VII. Magnetism

A. Electricity is produced when a magnet is moved past a piece of wire.

B. Also, a piece of wire can be moved through a magnetic field.

C. Motion, a magnetic field, and a piece of wire are needed to produce electricity.

VIII. Exotic Generators

A. The fuel cell is one of the latest developments for the production of electricity.

B. The oxygenconcentration cell includes an electrolyte.

1. The electrolyte conducts an electric charge in the form of oxygen ions, but acts as an insulator to electrons.

2. The electrolyte is located between two electrodes.

C. The hydrogen-oxygen cell produces water and electricity.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Generating and Distributing Electrical Power

TOPIC: Generating Electricity

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate an understanding of the processes of generating and distributing electrical power and the role of the electric utility company.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will be familiar with how electricity is generated.

REFERENCE: Student Information Sheet/Generating Electricity

DIRECTIONS: Read and answer each of the following questions in the space provided.

1. What is the definition of electricity?

2. How is electricity produced using friction?

3. How is electricity produced using pressure?

4. How is electricity produced using heat?

5. How is electricity produced using light?

6. How is electricity produced using chemical actions?

7. Give an example of how electricity produced by light is used.

8. Give an example of how electricity produced by chemical action is used.

9. Give an example of how electricity produced by pressure is used.

10. Give an example of how electricity produced by friction is used.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Generating and Distributing Electrical Power

TOPIC: Sources of Electrical Power

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate an understanding of the processes of generating and distributing electrical power and the role of the electric utility company.

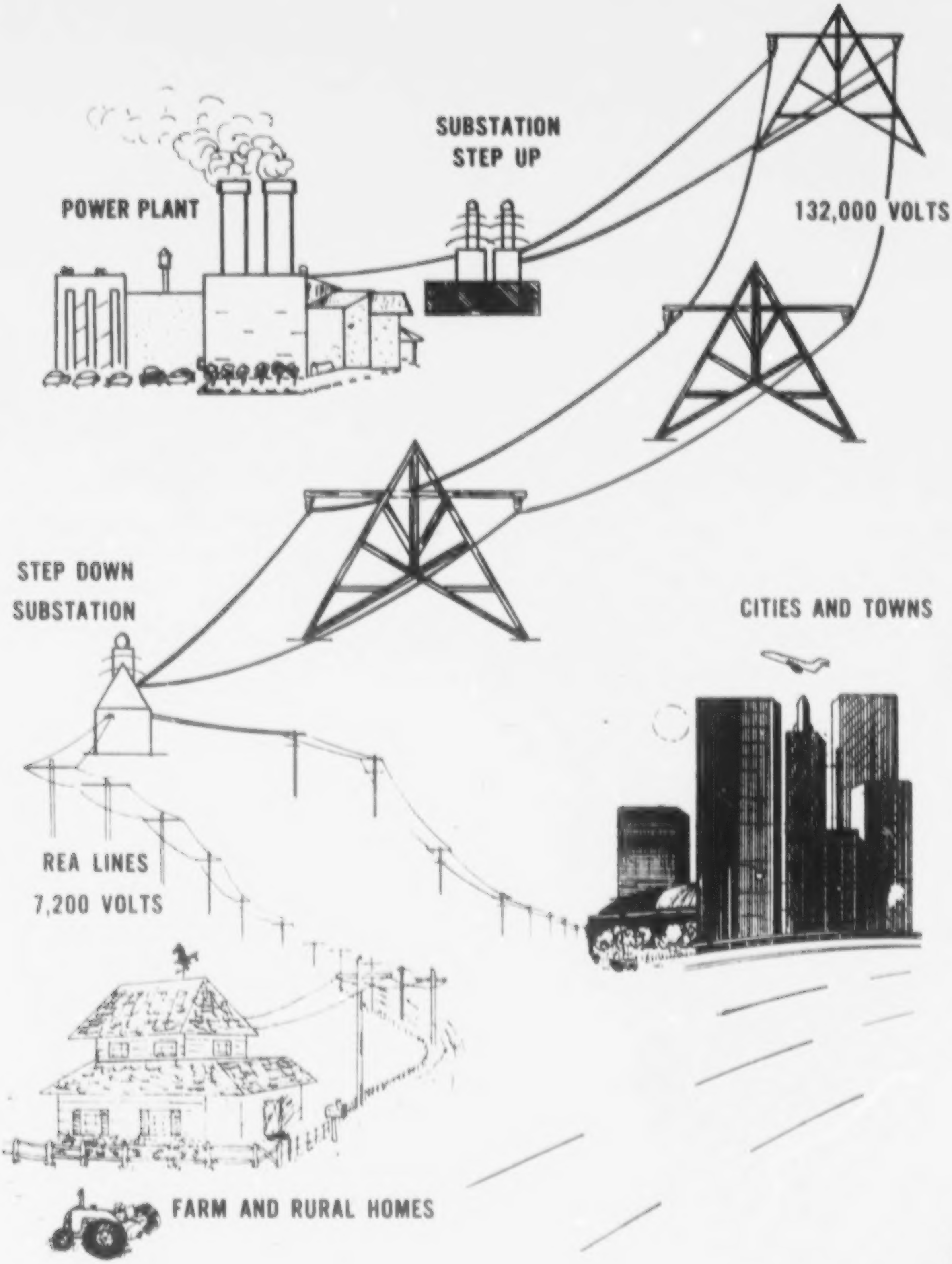
SPECIFIC OBJECTIVE(S): After completing this information sheet, the student will be able to discuss the sources of electrical power.

We use electrical power every day in every phase of our lives. It is taken for granted. When you walk into a room and flip a light switch you expect the light to come on. If you turn the knob on the radio you expect to hear music. These conveniences which all of us are use to rely on the power provided by electricity. Where does electricity come from? How is it made available for consumer use?

Electricity is produced by power plants. There are four types of electric power plants operating today. These include: hydro-electric plants, gas-fired electric plants, coal-fired electric plants, and atomic generating plants. Basically this means that electricity can be produced with a variety of fuels. In the future there may be new methods discovered which will make electricity available. Sometimes individuals choose to produce their own electricity. This is possible through the use of individually owned electrical generators. These generators may be wind-powered, gasoline-powered, or solar-powered. Excess electricity produced by these individually owned generators is purchased by local power companies and sold to other consumers. Power companies are simply companies which make electrical service available to consumers. There are different types of power companies operating. These may be publicly owned, privately owned, or cooperatives.

Electricity reaches the consumer through a series of steps. Power lines move the electricity from the power plants to the consumer. There are three types of power lines involved in the process of moving the electricity. **Transmission lines** are electrical lines that extend from generating plants to sub-stations or distribution centers. **Distribution lines** begin at the sub-station or distribution center and extend to the user. Distribution lines usually run under 20 miles. **Service lines** run from the meter to the point of use (for example: a house).

There are two types of electrical services used in residential dwellings. A 110-volt requires two service lines running to the house. A 220-volt requires three service lines running to the house.


SUBSTATION
STEP UP
POWER PLANT
132,000 VOLTS
STEP DOWN
SUBSTATION
CITIES AND TOWNS
REA LINES
7,200 VOLTS
FARM AND RURAL HOMES

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**____________________

UNIT: Generating and Distributing Electrical Power

TOPIC: Sources of Electrical Power

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate an understanding of the processes of generating and distributing electrical power and the role of the electric utility company.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will list sources of electrical power.

REFERENCE: Student Information Sheet/Sources of Electrical Power

DIRECTIONS: Answer each of the following in the space provided.

1. List four types of electrical power plants.

   a.

   b.

   c.

   d.

2. List three types of individually owned electrical generators.

   a.

   b.

   c.

3. List three types of power companies.

   a.

   b.

   c.

4. List the three types of power lines discussed and give a brief description of each.

   a.

b.

c.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Generating and Distributing Electrical Power

TOPIC: Uses of Electrical Power

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate an understanding of the processes of generating and distributing electrical power and the role of the electric utility company.

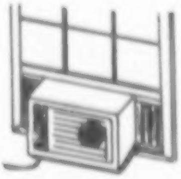
SPECIFIC OBJECTIVE(S): After completing this information sheet, the student will be able to discuss the uses of electrical power.

In the Student Information Sheet/Sources of Electrical Power you learned where electricity comes from. Have you ever stopped to think about how and where all the electricity which is produced is used? You have learned that there are two types of electrical services used in residential dwellings. Let's take a look at what these services are used for.

Electricity provides energy to light our homes, businesses, and industries. A high percentage of heating and cooling is powered by electricity. Power to operate appliances and machinery comes from electricity. Small appliances such as toasters, irons, televisions, etc. use a 110-volt electrical service. Larger appliances such as ranges, air conditioners, clothes dyers, or large machines often require the use of a 220-volt electrical service.

Communication centers are powered by electricity. We give little thought to how radio and television waves are made available. Without electrical power it would be impossible to transmit these signals.

There are many other uses of electricity which could be discussed. Many of the necessities and conveniences available would not be possible without electricity.



ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**__________________

UNIT: Generating and Distributing Electrical Power

TOPIC: Uses of Electrical Power

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate an understanding of the processes of generating and distributing electrical power and the role of the electric utility company.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will list uses of electrical power.

REFERENCE: Student Information Sheet/Uses of Electrical Power

DIRECTIONS: Answer each of the following in the space provided.

1. List the two types of electrical services used in residential dwellings and give three examples of what each one is used for.

   a.

      1)

      2)

      3)

   b.

      1)

      2)

      3)

2. List five ways in which you personally use electricity every day.

   a.

   b.

   c.

   d.

   e.

3. Write a paragraph about how your life would be different if electricity was no longer available.

UNIT VII

ELECTRICAL CODES

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Electrical Codes

TOPIC: History of the National Electrical Code

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to understand, identify, and apply electrical codes regulating residential electrical construction.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be familiar with the history of the National Electrical Code.

The National Association of Fire Engineers met in Richmond, Virginia in 1881. Out of this meeting came the proposal that served as a basis for the first National Electrical Code. Items covered included: the use of insulated conduit, the use of single disconnect devices, and the identification of the white wire. The first nationally recommended electrical code was published by the National Board of Fire Underwriters (now the American Insurance Association) in 1895.

In 1911, the National Fire Protection Association (NFPA) assumed sponsorship and control of the National Electrical Code. The National Electrical Code is acknowledged to be the most widely adopted code of standard practice in the U.S.A. The Code is revised and updated every three years.

Changes to the Code are summarized at the beginning of the publication. The purposes of the Code is the practical safeguarding of persons and property from hazards arising from the use of electricity. The Code contains provisions considered necessary for safety. Compliance therewith and proper maintenance will result in an installation essentially free from hazard, but not necessarily efficient, convenient or adequate for good service or future expansion of electrical use.

The Code was not designed as an instruction manual or design specification for untrained persons. It is intended to be used by capable engineers and electrical contractors for the basic design and/or installation of electrical equipment; by inspection authorities exercising legal jurisdiction over electrical installation; by property insurance inspectors; by qualified industrial, commercial, and residential electricians; and by instructors teaching electrical apprentices or students.

Items covered by the Code include: installations of electric conductors and equipment within or on public and private buildings or other structures, including mobile homes, recreational vehicles, and floating buildings; and other premises such as yards, carnivals, parking and other lots, and industrial substations.

There are circumstances under which the authority having jurisdiction for enforcing the Code may grant exceptions. These are detailed in 90-2(c) of the Code.

The Code book may be obtained from:

National Fire Protection Association
470 Atlantic Avenue
Boston, Massachusetts 02110

Schram, Peter J. Editor, The National Electric Code Handbook. Quincy, Massachusetts: National Fire Protection Association, 1987

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Electrical Codes

TOPIC: History of the National Electrical Code

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to understand, identify, and apply electrical codes regulating residential electrical construction.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate a knowledge of the history of the National Electrical Code.

REFERENCE: Student Information Sheet/History of the National Electrical Code

DIRECTIONS: Read each of the following statements. If the statement is true, circle the T, if false, circle the F.

1. The proposal which served as a basis for the first National Electrical Code came out of a meeting held in Richmond, Virginia in 1881. T F
2. The first nationally recommended electrical code was published in 1901. T F
3. The Code is revised and updated every six years. T F
4. The Code is not intended as an instruction manual for untrained persons. T F
5. Under no circumstances are exceptions to the Code granted. T F

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Electrical Codes

TOPIC: Using the National Electrical Code

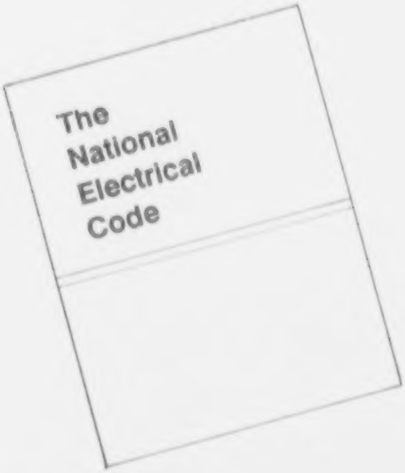
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to understand, identify, and apply electrical codes regulating residential electrical construction.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to use the National Electrical Code.

In order to understand and apply the Code, you must first become familiar with the publication. The Code provides a listing of terms and their definitions which are used within the Code. These definitions are presented in Article 100 of the Code.

An index is provided in the back of the publication which will direct you by article number to each informational area. For example if you need information regarding the requirements of short circuit protection for electric motors, you will look first at "Motors" and the index will direct you to article 430. However, under the listing of "Motors" in the index you will see "short circuit protection, 430-D, 430-E." This directs you not only to the article number but also to the section of the article which covers short circuit protection for electric motors.

As you work in electrical trades it will be necessary that you understand how to use and apply the Code.



ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:________________________________ **DATE:**________________________

UNIT:	Electrical Codes
TOPIC:	Using the National Electrical Code
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to understand, identify, and apply electrical codes regulating electrical construction.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate the ability to use the National Electrical Code.
REFERENCE:	Student Information Sheet/Using the National Electrical Code
DIRECTIONS:	Using the National Electrical Code provided by your instructor locate the correct article number for each of the items listed below.

1. Overcurrent protection on extension cord sets

2. Grounding requirements for air-conditioning units

3. Switches used to disconnect or control electric motors

4. Receptacles for cooking ranges

5. Calculating load of branch circuit for lighting

6. Covers for junction boxes

7. Fuse ratings

8. Using circuit breakers as overcurrent protection for generators

9. When is the use of cords not permitted?

10. Installing service-entrance cable, Type SE,USE

UNIT VIII

BLUEPRINTS AND SCHEMATIC DIAGRAMS

BLUEPRINTS
AND SCHEMATIC
DIAGRAMS

STUDENT INFORMATION SHEET

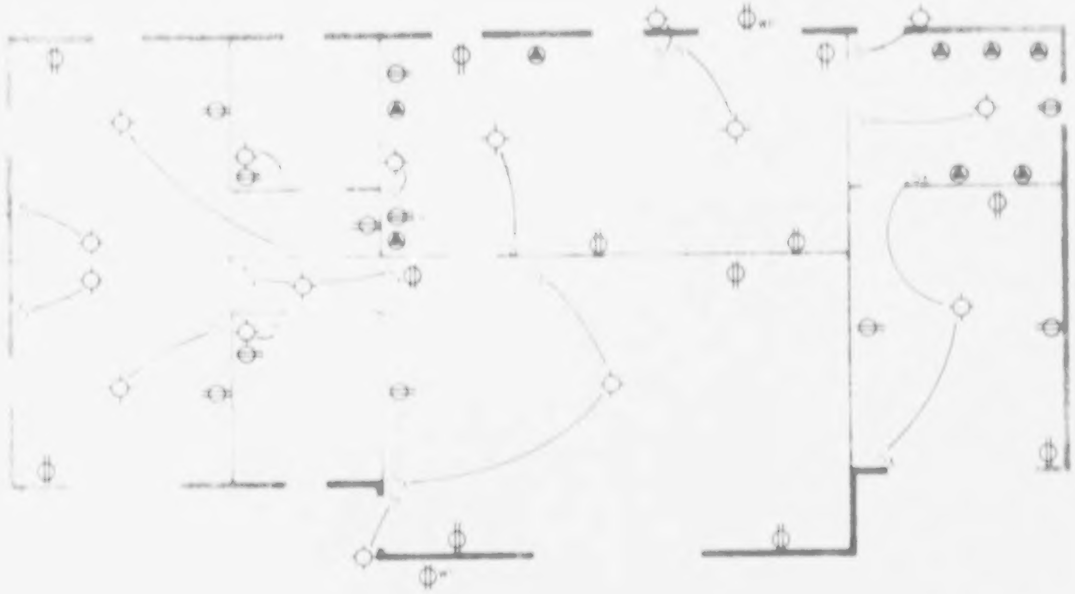
ELECTRICAL TRADES I

UNIT:	Blueprints and Schematic Diagrams
TOPIC:	What is a Blueprint?
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will explain what a blueprint is and how it is used.

A blueprint is a working drawing of an object that is to be constructed. Blueprints are instructions that use a picture with symbols, abbreviations, and written explanations to identify parts of the drawings.

As an electrician it is your job to place plugs, lights and special devices where the engineer wishes to place them. It is usually not acceptable for an electrician to alter these plans without consulting others. The electrician must be able to read blueprints. These prints show what device is to be used and where it will be placed. It also shows if switches control these devices.

Blueprints are drawn on paper which is flat and show one surface at a time. It takes many pages to show a 3 dimensional object such as a building. The electrician should study all the prints.



ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:________________________________ **DATE:**________________________

UNIT:	Blueprints and Schematic Diagrams
TOPIC:	What is a Blueprint?
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will explain what a blueprint is and how it is used.
REFERENCE:	Student Information Sheet/What is a Blueprint?
DIRECTIONS:	Fill in the blank.

1. A blueprint is a _________ of an object that is to be constructed.
2. Blueprints use _________ with _________ abbreviations, and written _________ to parts of the drawings.
3. Blueprints show what 3 things?

   A.

   B.

   C.
4. Blueprints are _________ dimensional plans showing _________ dimensional objects.
5. It is up to the _________ to decide where the devices are to be placed.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Blueprints and Schematic Diagrams

TOPIC: Symbols

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to correctly identify symbols.

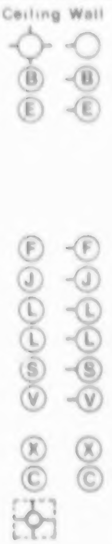
As an electrician you must be able to read and interpret residential blueprints and schematic diagrams correctly. In order to do this the electrician must be familiar with the symbols which are used in the drawings.

Symbols are drawings which represent many items. Due to the limited size of blueprint and schematic drawings it was necessary to establish a set of symbols which could be recognized by everyone using the drawings.

Following is a listing of electrical symbols. It is important that you study these symbols until you are able to read each one and interpret what it stands for.

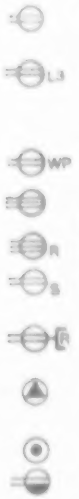
ELECTRICAL SYMBOLS

GENERAL OUTLETS



Outlet.
Blanked Outlet.
Electrical Outlet--for use only when circle used alone might be confused with columns, plumbing symbols, etc.
Fan Outlet.
Junction Box.
Lamp Holder.
Lamp Holder with Pull Switch.
Pull Switch.
Outlet for Vapor Discharge Lamp.
Exit Light Outlet.
Clock Outlet. (Specify Voltage.)
Ceiling Outlet for Recessed Fixture.

CONVENIENCE RECEPTACLES



Duplex Convenience Receptacle.
Convenience Receptacle other than Duplex. 1 = Single, 3 = Triplex, etc.
Weatherproof Convenience Receptacle.
240 V Outlet.
Range Receptacle.
Switch and Convenience Receptacle.
Radio and Convenience Receptacle.
Special Purpose Receptacle (Des. in Spec.)
Floor Receptacle.
Split Duplex Receptacle.

SWITCH OUTLETS

S	Single Pole Switch.
S_2	Double Pole Switch.
S_3	Three Way Switch.
S_4	Four Way Switch.
S_D	Automatic Door Switch.
S_E	Electrolier Switch.
S_K	Key Operated Switch.
S_P	Switch and Pilot Lamp.
S_{CB}	Circuit Breaker.
S_{WCB}	Weatherproof Circuit Breaker.
S_{MC}	Momentary Contact Switch.
S_{RC}	Remote Control Switch.
S_{WP}	Weatherproof Switch.
S_F	Fused Switch.
S_{WF}	Weatherproof Fused Switch.

PANELS, CIRCUITS AND MISCELLANEOUS

▬	Lighting Panel.
▨	Power Panel.
——	Branch Circuit; Concealed Ceiling or Wall.
– – –	Branch Circuit; Concealed in Floor.
-----	Switch Leg of Circuit.
→→	Home Run to Panel Board. Indicate number of Circuits by number of arrows. Note: Any circuit without further designation indicates a two-wire circuit. For a greater number of wires indicate as follows: (3 wires), (4 wires), etc.
≡□≡	Underfloor Duct and Junction Box. Triple System. Note: For double or single systems eliminate one or two lines. This symbol is equally adaptable to auxiliary system layouts.
Ⓖ	Generator.
Ⓜ	Motor.
Ⓘ	Instrument.
Ⓣ	Power Transformer. (Or draw to scale.)
⊠	Controller.
□	Isolating Switch.

AUXILIARY SYSTEMS

⊡	Push Button.
□/	Buzzer.
□○	Bell.
–◇	Annunciator.
◀	Outside Telephone.
◁	Interconnecting Telephone.
[◀	Telephone Switchboard.
Ⓣ	Bell Ringing Transformer.
D	Electric Door Opener.
F○	Fire Alarm Bell.
F	Fire Alarm Station.
⊠	City Fire Alarm Station.
FA	Fire Alarm Central Station.
FS	Automatic Fire Alarm Device.
W	Watchman's Station.
[W]	Watchman's Central Station.
H	Horn.
N	Nurse's Signal Plug.
M	Maid's Signal Plug.
R	Radio Outlet.
SC	Signal Central Station.
□	Interconnection Box.
‖‖	Battery.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________ **DATE:** ______________________

UNIT: Blueprints and Schematic Diagrams

TOPIC: Symbols

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate the ability to correctly identify symbols.

REFERENCE: Student Information Sheet/Symbols

DIRECTIONS: Correctly identify each of the following symbols.

1. ______________________

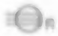
2. ______________________

3. S ______________________

4. ______________________

5. S_3 ______________________

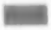
6. S_4 ______________________

7.  ______________________

8. S_D ______________________

9. S_P ______________________

10. ______________________

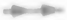
11.  ______________________

12. ______________________

13. ______________________

14. ______________________

15. ______________________

16.  ______________________

17. ----- ______________________

18. ______________________

19. ______________________

20. ______________________

STUDENT INFORMATION SHEET

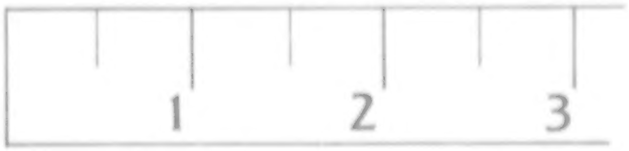
ELECTRICAL TRADES I

UNIT:	Blueprints and Schematic Diagrams
TOPIC:	Reading a Ruler
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will demonstrate the ability to read a ruler.

In most cases an electrician should be able to measure to the nearest 1/8". In some cases an electrician must measure to the nearest 1/16" and even 1/32".

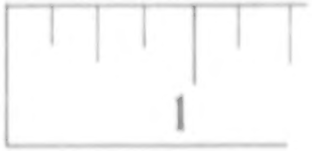
Study the following drawings of rulers until you become familiar with the graduation marks on each ruler.

HALVES

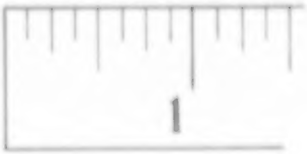


BLUEPRINTS AND SCHEMATIC DIAGRAMS

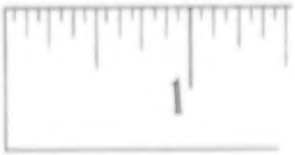
QUARTERS



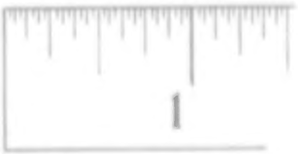
EIGHTHS



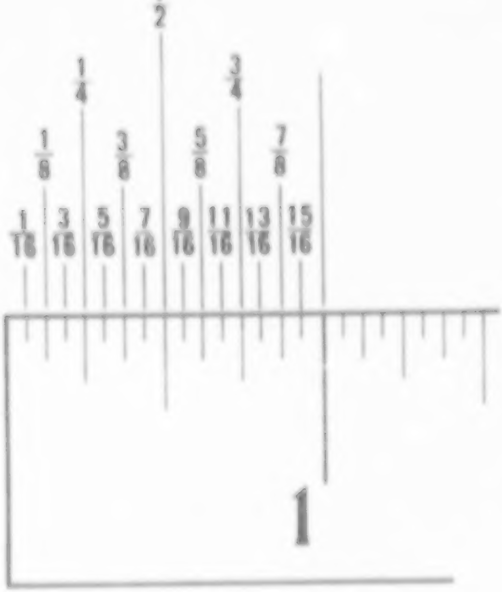
SIXTEENTHS



THIRTY-SECONDS



GRADUATIONS APPLIED TO A RULE


1/2
1/4
3/4
1/8
3/8
5/8
7/8
1/16
3/16
5/16
7/16
9/16
11/16
13/16
15/16
1

BLUEPRINTS
AND SCHEMATIC
DIAGRAMS

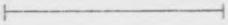
ASSIGNMENT SHEET

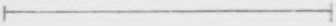
ELECTRICAL TRADES I

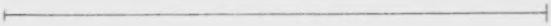
NAME:______________________________ **DATE:**______________________

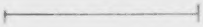
UNIT:	Blueprints and Schematic Diagrams
TOPIC:	Reading a Ruler
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate the ability to read a ruler.
REFERENCE:	Student Information Sheet/Reading a Ruler
DIRECTIONS:	Measure various lines.

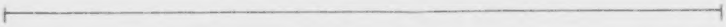
Measure to the nearest 1/8"

_____ 1. 

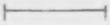
_____ 2. 

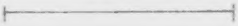
_____ 3. 

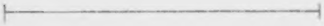
_____ 4. 

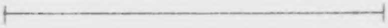
_____ 5. 

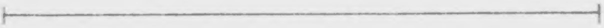
Measure to the nearest 1/16"

_____ 6. 

_____ 7. 

_____ 8. 

_____ 9. 

_____ 10. 

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Blueprints and Schematic Diagrams

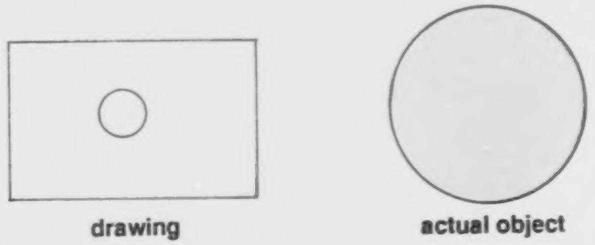
TOPIC: Blueprint Scale

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to convert scaled drawing into actual size.

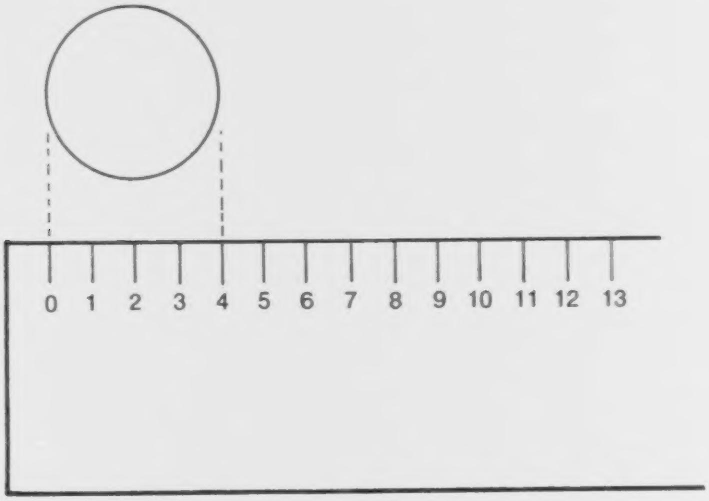
The scale of a drawing is the amount the drawing is smaller or larger, than that of the object. Since we can not draw a house to its full size on a small sheet of paper we use a reduced scale. If we draw a house as if it was shrunk about 40 times smaller then we could put a 40' house on a 12" drawing.

The scale here is 1 to 2.



When reading architectural drawings we sometimes use an architect's scale. This is a ruler in the same graduations of scale as on plans. If we have a scale of 1/8" = 1' then we use 1/8" scale.

Object would be 4 feet in diameter.



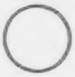
ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

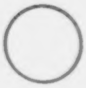
UNIT:	Blueprints and Schematic Diagrams
TOPIC:	Blueprint Scale
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will be able to convert scaled drawing into actual size.
REFERENCE:	Student Information Sheet/Blueprint Scale
DIRECTIONS:	Write actual diameter using scale given.

_____ 1.



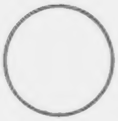
1/8" = 1'

_____ 2.



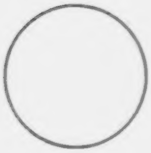
1/16" = 1'

_____ 3.



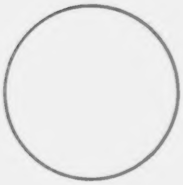
1/8" = 1'

_____ 4.



1/16" = 1'

_____ 5.



1/8" = 1'

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Blueprints and Schematic Diagrams

TOPIC: Blueprint Lines

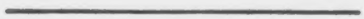
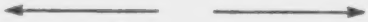
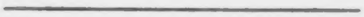
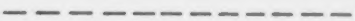
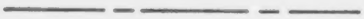
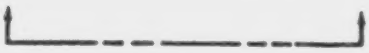
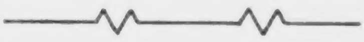
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.

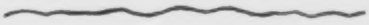
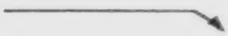
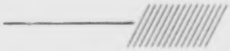
SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to identify blueprint lines.

Blueprint lines make up the working drawings. The electrician must recognize that not all lines are solid walls. It is important to be able to see hidden objects you would not normally see.

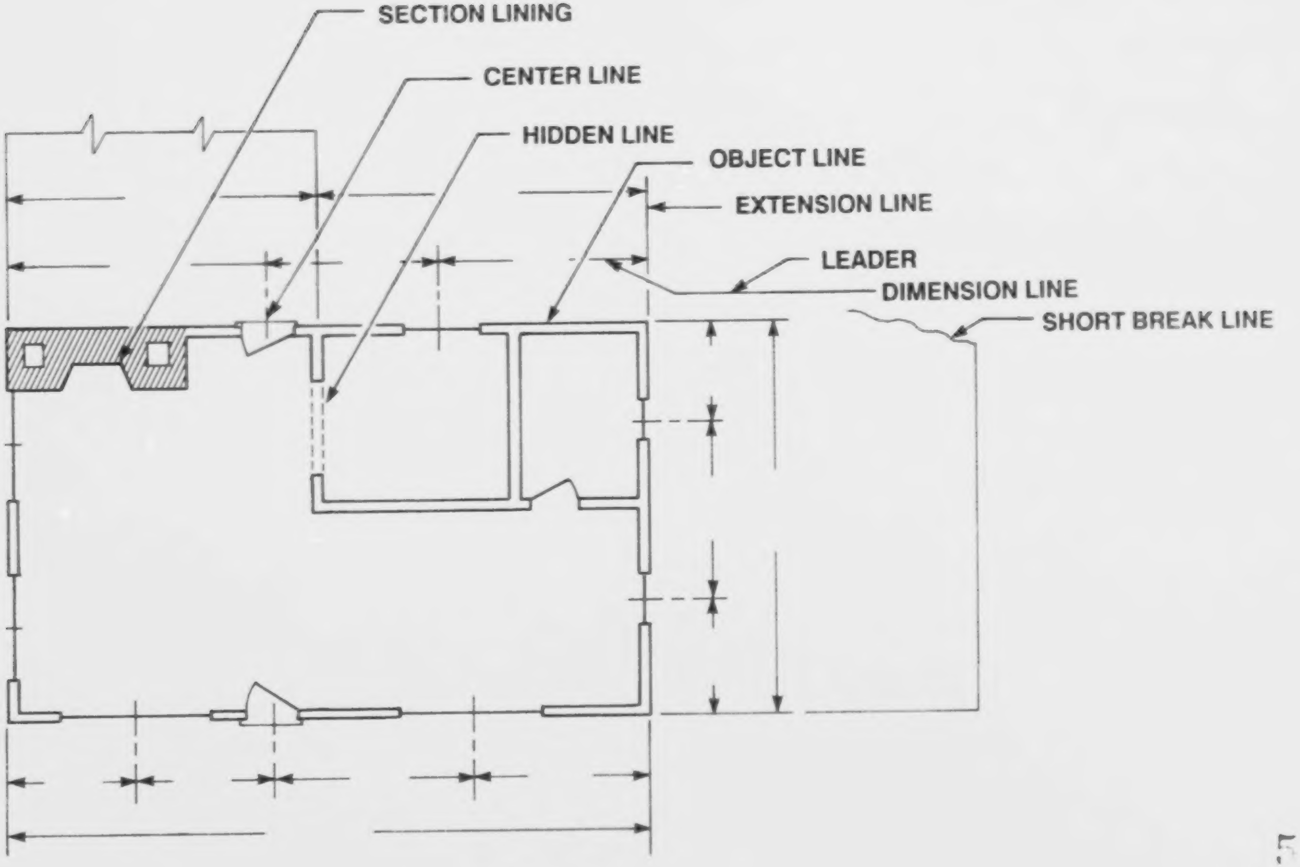
Study the following charts carefully. Knowing low lines differ and what each represents will assist you in reading and interpreting blueprints correctly.

BLUEPRINT LINES

OBJECT LINE	
DIMENSION LINE	
EXTENSION LINE	
HIDDEN LINE	
CENTER LINE	
CUTTING PLANE	
BREAK LINE-LONG	

BREAK LINE-SHORT	
LEADER	
SECTION LINING	

READ BLUEPRINT LINES


SECTION LINING
CENTER LINE
HIDDEN LINE
OBJECT LINE
EXTENSION LINE
LEADER
DIMENSION LINE
SHORT BREAK LINE

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:________________________________ **DATE:**________________________

UNIT: Blueprints and Schematic Diagrams

TOPIC: Blueprint Lines

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate the ability identify blueprint lines.

REFERENCE: Student Information Sheet/Blueprint Lines

DIRECTIONS: Correctly identify the blueprint lines used in the drawing by placing the correct letter in the blank.

A. Dimension Line

B. Hidden Line

C. Section Lining

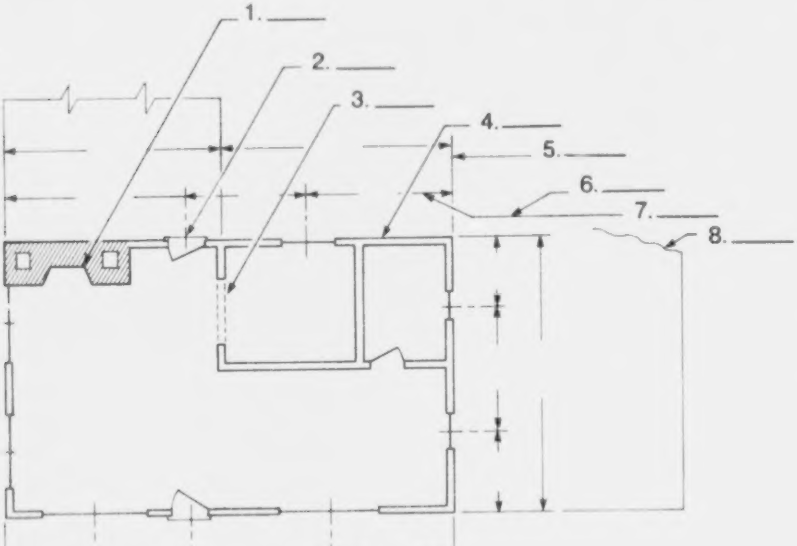
D. Short Break Line

F. Center Line

F. Extension Line

G. Object Line

H. Leader



STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Blueprints and Schematic Diagrams

TOPIC: Architect's Plans

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to list the types of drawings in a complete set of prints.

Blueprints are made up of many types of plans, each one showing different aspects of the building.

1. The Plot Plan shows the house lot and the house position on the lot.
2. The Elevation Drawings show the outside of house and some interior walls which need to be explained.
3. The Floor Plans show the wall positions of house, fixture positions, and device positions.
4. Detail Drawings show objects which need to be explained further usually by drawing objects bigger so details can be seen easier.
5. Section Drawings are cut-away drawings showing inside walls and other objects.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT:	Blueprints and Schematic Diagrams
TOPIC:	Architect's Plans
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate an understanding of the types of drawings in a complete set of prints.
REFERENCE:	Student Information Sheet/Architect's Plans
DIRECTIONS:	Explain what each plan shows in the space provided.

1. Plot Plan -

2. Elevation Plan -

3. Floor Plans -

4. Detail Drawings -

5. Section Drawings -

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Blueprints and Schematic Diagrams

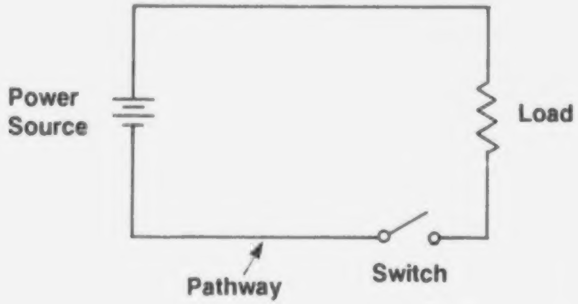
TOPIC: Schematic Diagrams

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to identify the basic parts of a schematic diagram.

A schematic diagram is a representation of which wire connects to which terminal. It does not necessarily show the actual location of each wire.

A schematic will show the power source, the pathway or wires, the loads or resistances, and any switching devices that may stop the flow through the pathway.



ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Blueprints and Schematic Diagrams

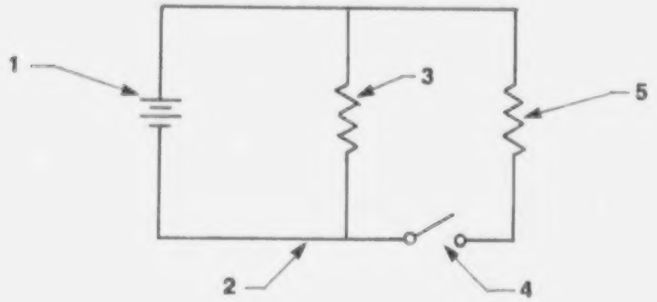
TOPIC: Schematic Diagrams

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate the ability to identify the basic parts of a schematic diagram.

REFERENCE: Student Information Sheet/Schematic Diagrams

DIRECTIONS: Label each part of the schematic diagram.



1. ________________
2. ________________
3. ________________
4. ________________
5. ________________

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Blueprints and Schematic Diagrams

TOPIC: Types of Schematic Diagrams

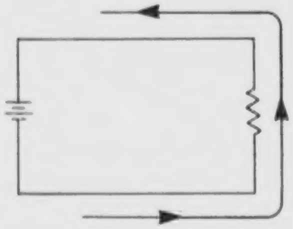
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to distinguish among series, parallel, and complex circuits.

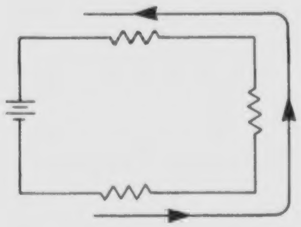
In a schematic amperage flows through the pathways starting at the source. The path amperage may take determines if it is a series circuit, parallel circuit, or both put together called a complex circuit.

A series has only one pathway back to the source. It may have one or more resistors but only one path.

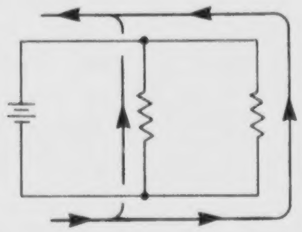
Example:



or

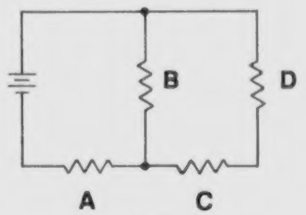


A parallel circuit has more than one pathway.



Note the branch off points. If an electron can travel two roads then it is parallel.

A complex circuit has resistors placed in both series and parallel orders. Some resistors are in series with one another and some are parallel with each other.



ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:________________________________ **DATE:**________________________

UNIT: Blueprints and Schematic Diagrams

TOPIC: Types of Schematic Diagrams

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to read and interpret residential blueprints and schematic diagrams.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate the ability to distinguish among series, parallel, and complex circuits.

REFERENCE: Student Information Sheet/Types of Schematic Diagrams

DIRECTIONS: 1. Explain differences between series, parallel, and complex circuits.

2. Matching. Place choice in blank.

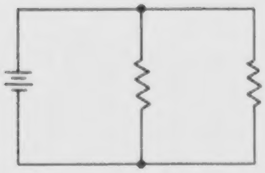
Choices
(One answer will be used two times)

A. Series

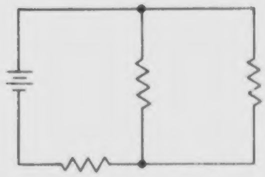
B. Parallel

C. Complex

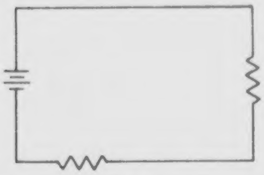
_____ A.



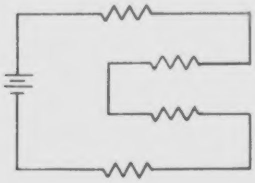
_____ B.



_____ C.



_____ D.



UNIT IX

PLANNING THE JOB

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Planning the Job

TOPIC: Terms and Definitions for Residential Services

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to define terms associated with residential services.

Adapted from (NEC Art 100)

1. **Service drop**--The conductors dropping from the pole to the point of attachment on the residence.
2. **Service lateral**--The underground conductors from the transformer or street junction to the residence.
3. **Service raceway**--The conduit, gutter, or other enclosure that covers service conductors.
4. **Service conductors**--Conductors running from transformer to service entrance equipment. This can be an overhead or underground (lateral) system.
5. **Service mast**--The conduit that rises in the air in which service conductors attach to drop.
6. **Weatherhead**--Device which prevents water from entering the service mast.
7. **Meter base**--Box where the terminals are fixed for service entrance conductors to feed the meter.
8. **Meter**--Device that reads the wattage used at the residence.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Planning the Job

TOPIC: Terms and Definitions for Residential Services

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate the ability to define terms associated with residential services.

REFERENCE: Electrical Trades I/Student Information Sheet and Assignment Sheet/Terms and Definitions for Residential Services

DIRECTIONS: Define each of the following terms in the space provided.

1. Service drop-

2. Service lateral-

3. Service raceway-

4. Service conductors-

5. Service mast-

6. Weatherhead-

7. Meter base-

8. Meter-

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Planning the Job

TOPIC: Planning Information

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate an understanding of the type of information you must know in order to plan a residential service entrance.

INFORMATION THAT YOU MUST KNOW

1. **WHERE THE POWER COMPANY WOULD LIKE THE SERVICE ENTRANCE PLACED (which side of the house)**
2. **IF SERVICE WILL BE OVERHEAD OR LATERAL**
3. **VOLTAGE AND AMPERAGE NEEDED FOR THE HOUSE**
4. **RATINGS OF SERVICE EQUIPMENT NEEDED**

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Planning the Job

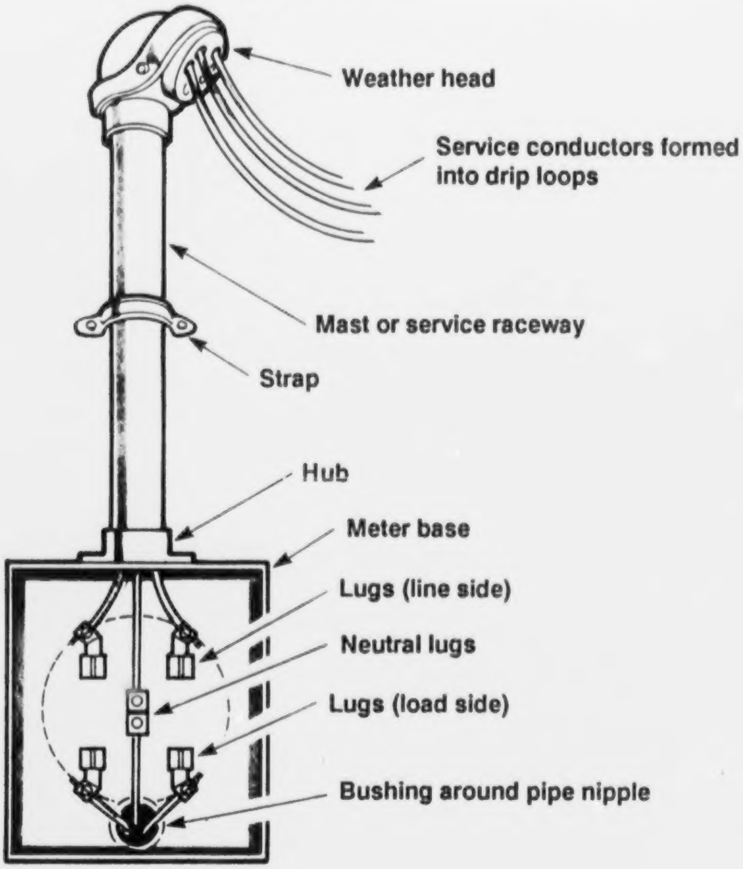
TOPIC: The Overhead Service

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to identify parts of an overhead service.

Study the drawing below. Make sure that you are able to identify each part of the overhead service.

OVERHEAD SERVICE


Weather head
Service conductors formed into drip loops
Mast or service raceway
Strap
Hub
Meter base
Lugs (line side)
Neutral lugs
Lugs (load side)
Bushing around pipe nipple

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:____________________________ **DATE:**____________________

UNIT: Planning the Job

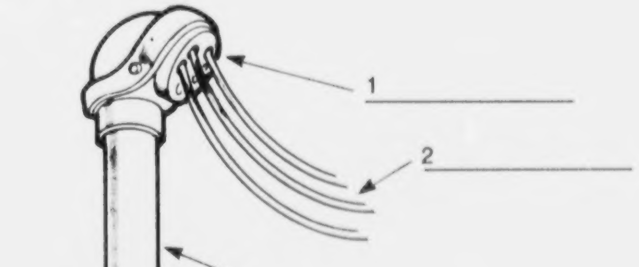
TOPIC: Identifying Parts of an Overhead Service

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will identify the parts of an overhead service.

REFERENCE: Electrical Trades I/Student Information Sheet/The Overhead Service/Assignment Sheet/Identifying Parts of an Overhead Service

DIRECTIONS: Label each part of the overhead service shown below.



PLANNING THE JOB

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

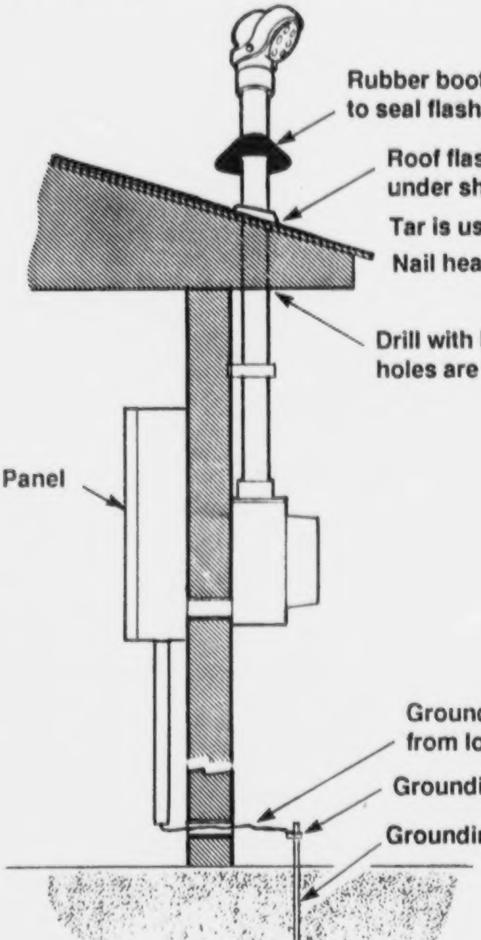
UNIT: Planning the Job

TOPIC: Roof Penetration

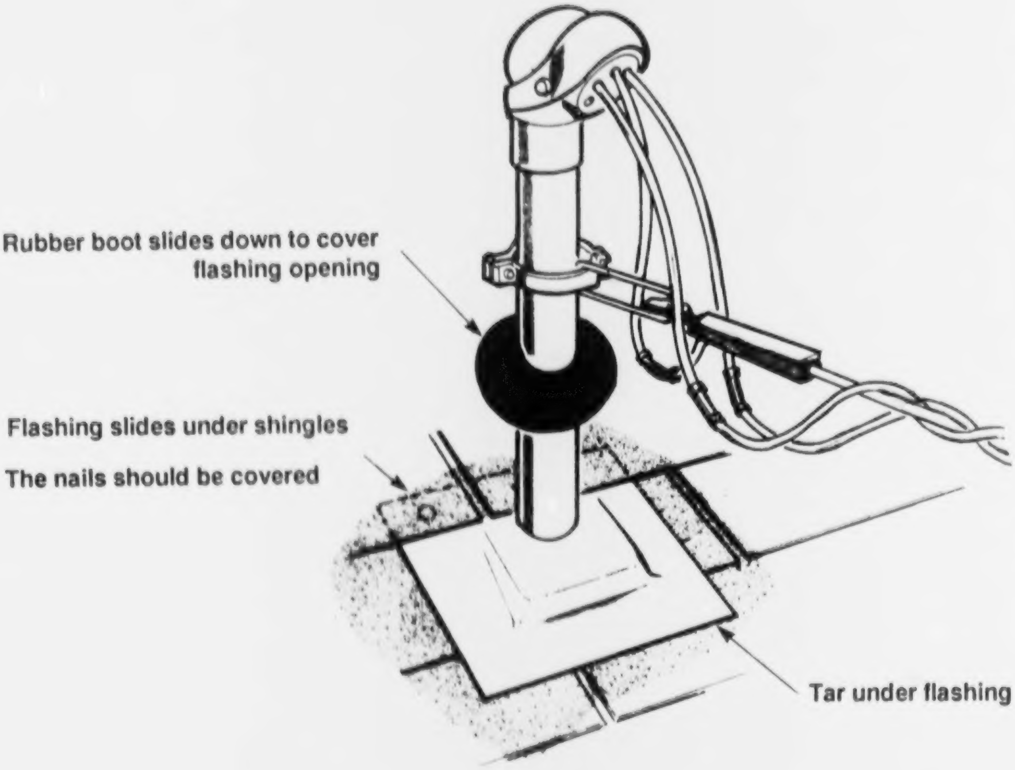
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to discuss roof penetration.

Study the drawing below. Make sure that you are familiar with roof penetration.



Rubber boot-slides over raceway to seal flashing gaps
Roof flashing-metal plate that slides under shingles to shed water
Tar is used under the roof flashing
Nail heads should be covered
Drill with hole saw making sure the holes are in line with each other
Panel
Grounding electrode conductor usually from load center (Panel)
Grounding clamp
Grounding electrode (grounding rod)


Rubber boot slides down to cover flashing opening
Flashing slides under shingles
The nails should be covered
Tar under flashing

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:_______________________________ **DATE:**_______________________

UNIT: Planning the Job

TOPIC: Understanding the Process of Roof Penetration

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will identify the process of roof penetration.

REFERENCE: Electrical Trades I/Student Information Sheet/Roof Penetration/Assignment Sheet/Understanding the Process of Roof Penetration

DIRECTIONS: Read each of the following statements. If the statement is true, circle the T. If the statement is false, circle the F.

T F 1. The rubber boot slides over the raceway to seal flashing gaps.

T F 2. The flashing goes on top of the shingles.

T F 3. Tar should be used under the flashing.

T F 4. A hole saw is used to drill the hole through the roof overhang.

T F 5. A grounding clamp is used to clamp the grounding electrode conductor to the grounding electrode.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Planning the Job

TOPIC: Overhead Service Clearances

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to discuss clearances of overhead services.

CLEARANCES FOR SERVICE DROPS OF 600 VOLTS OR LESS

NEC Article 230

The lowest end of the drip loop must be at these specified heights from ground:

10 feet if voltage is under 150 volts;

12 feet if voltage is under 300 volts and lines pass over residential property, driveways and areas not subject to truck traffic;

15 feet if voltage is from 300 to 600 volts and passing over residential property; and

18 feet if lines under 600 volts pass over streets, alleys, and parking areas approved for truck traffic.

CLEARANCE OF DRIP LOOP ABOVE ROOF

If the roof has a slope of not less than 4 inches to 12 inches, a 3 foot clearance (or more) will be permitted if voltage is 300 volts or less.

If the lines do not pass over 4 feet of overhang and the voltage is 300 volts or less, then a minimum of 18 inches above the roof line will be permitted.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Planning the Job

TOPIC: Planning an Overhead Service

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate a knowledge of roof penetrations and height clearances.

REFERENCE: Electrical Trades I/Student Information Sheet/Overhead Service Clearances/Assignment Sheet/Planning an Overhead Service

DIRECTIONS: Draw a picture of how an overhead service is installed. Include information on roof penetration and the correct height clearances.

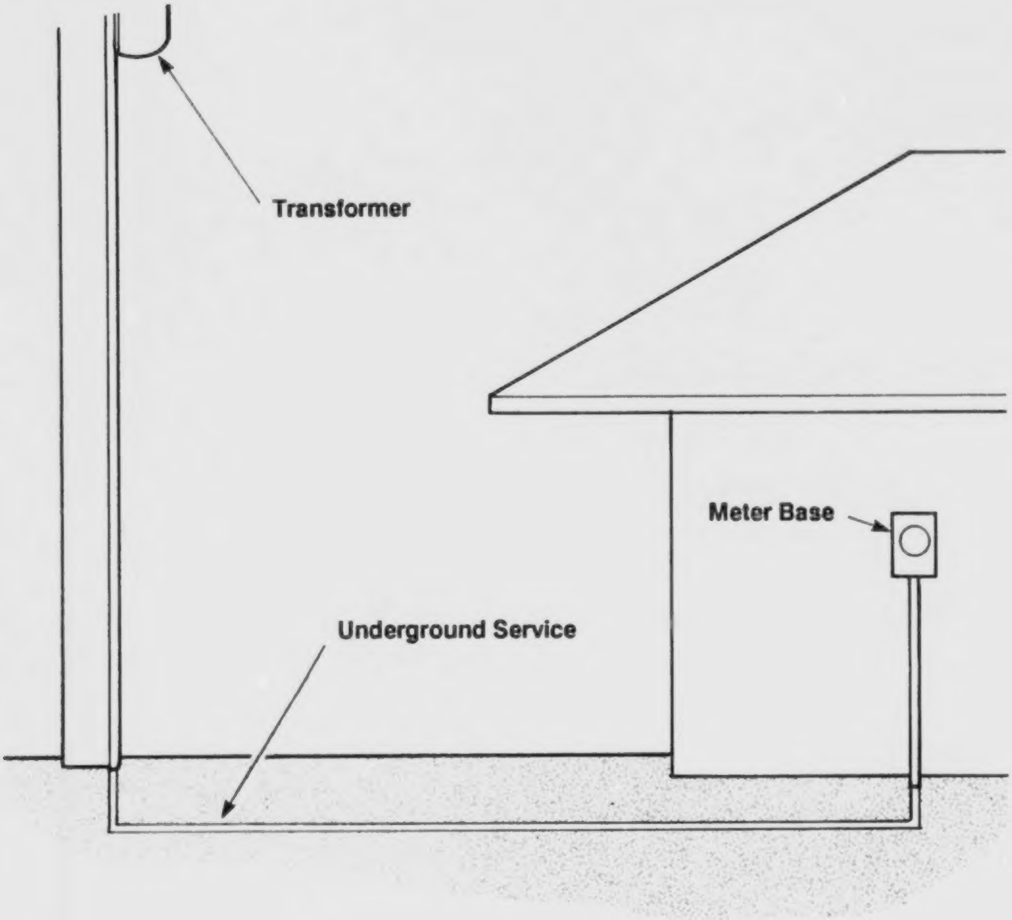
PLANNING THE JOB

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT:	Planning the Job
TOPIC:	Comparing Service Entrance Methods
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will demonstrate the ability to compare underground and overhead service entrances.

Study the drawing below. Make sure that you are able to identify the parts of an underground service entrance.



ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Planning the Job

TOPIC: The Underground Service Entrance

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will draw and label an underground service entrance.

REFERENCE: Electrical Trades I/Student Information Sheet/Comparing Service Entrance Methods/Assignment Sheet/The Underground Service Entrance

DIRECTIONS: Draw a picture of how an underground service is installed. Label each of the parts.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Planning the Job

TOPIC: Types of Circuits

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate an understanding of various types of circuits.

When you begin planning electrical circuits, you will find that there are different types of circuits used. Following is a brief description of each.

1. **General Purpose Circuit**--convenience lights and plugs
2. **Small Appliance Circuit**--circuits used to provide power for toasters, coffee pots, etc. Usually in kitchens and breakfast nooks
3. **Individual Circuits**--special purpose circuit for an individual appliance such as a washer, dishwasher, or range

GENERAL PURPOSE CIRCUITS

General purpose circuits are circuits used around the house for plugging in various small devices for lighting and general use appliances. These circuits are to be used on 15 and 20 amp breakers. General purpose outlets are usually figured at 180 watts each. If you take a 20 amp circuit and multiply by 120 volts, you get 2400 watts. This is not the number used to figure the number of plugs on the circuit however. You must not load the circuit to 20 amps or the breaker will be tripped. Instead, you will use 80 percent of this amount which equals 1920 watts. Now divide the 1920 watts by 180 watts (the number of watts per plug) which equal 10.6 outlets. You must then round down to the nearest whole number. This gives 10 plugs for a 20 amp circuit.

This number can vary in that lights may be used on the circuit in place of plugs. The wattage for lights will vary. It is up to the electrician to determine which devices will go on each circuit in order not to exceed 80 percent of the overcurrent protection. It is a good practice to estimate devices as follows:

Closet lights	60 watts
Bedroom lights	200 watts
Convenience outlets	180 watts

Chandeliers	600 watts
Ceiling fans and lights	200 watts

SMALL APPLIANCE CIRCUITS

There must be a minimum of two small appliance circuits in the kitchen and one in the laundry room. The electrician or architect may group these to their preference. Some larger kitchens may require three or more small appliance circuits. There should be an outlet above any counter space 12 inches or wider. The outlet in the laundry room must be within 6 feet of appliances.

HOW TO GROUP GENERAL PURPOSE CIRCUITS

When determining where to put outlets and lights, remember:

1. There must be an outlet every 12 feet of wall space and on any wall space 2 feet wide.
2. There must be at least one outside receptacle on GFIC protection.
3. There must be one receptacle in bathrooms on GFIC protection.
4. There must be one receptacle in basements and one in the garage.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Planning the Job

TOPIC: What Are the Requirements?

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be familiar with how amperage needs are calculated.

HOW TO CALCULATE AMPERAGE NEEDED

It should be known that the master electrician or the electrical engineer usually makes the load calculation of a building. The electrician must use Table 220-3(b), Table 220-11, and Article 220-2, 220-11, and 220-16 in order to do this.

Voltages to a single family dwelling (house) are going to be figured at 120V or 120/240V. In some areas voltages may vary plus or minus 5 volts.

Amperages may be figured by determining the wattage the residence will use. A house has various loads that must be figured. This includes general lighting, small appliances, individual loads for large appliances, and some derations that reduce amounts needed.

FIGURING GENERAL LIGHTING LOAD

We have 2,360 square feet.

Table 220-3(b) tells us to multiply the square feet by 3 if we are figuring for a dwelling unit.

2,360 sq. ft.
x3 watts per sq. ft.
7,080 watts

Now we also figure the small appliance loads demanded by code 220-16(a,b).

We must have two 1500 watt circuits for the kitchen area and one 1500 watt circuit for the laundry.

This gives us an additional 4500 watts.

7,080 watts general lighting
+4,500 watts
11,580 watts

Now the code says we can derate this number because it is unlikely that all of it will be on at the same time. Table 220-11 shows deration.

11,580	
-3,000	Take the 1st 3000 watts at a full 100 percent.
8,580	The remainder up to 120000 watts is figured at only 35 percent.
x .35	
3,003	watts
+3,000	This is 35 percent of 8,580 plus the 100 percent of 3,000.
6,003	watts - This is the total needed for load calculation.

You must also figure other appliances, but first you should practice what has been taught.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Planning the Job

TOPIC: Figuring Demand Ratings

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will figure general purpose demand ratings.

REFERENCE: Electrical Trades I/Student Information Sheet/What Are the Requirements?/Assignment Sheet/Figuring Demand Ratings

DIRECTIONS: Complete the practice below.

1. Figure the general lighting load needed for a single family dwelling unit 3,000 sq. ft.

2. Figure the general lighting load needed for a single family dwelling unit with 27,000 sq. ft.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Planning the Job

TOPIC: Ranges

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate an understanding of how to figure the demand load for ranges.

RANGES

Study the range load table 220-19.

Our residence has a 15.5kw range. The code says that we may use column A with note 1. Column one says we use 8kw + note 1. Note 1 says we add 5 percent for each additional kw or major fraction for anything over 12kw.

15.5 kw - 12kw = 3.5kw

4.0 *This is the major fraction.*
x.05
.20

8kw x 1.2 = 9.6kw

100 percent of 8kw + 20 percent of 8kw = 9.6kw

As you can see, we went from 15.5kw to 9.6kw after deration.

Practice a few range calculations.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Planning the Job

TOPIC: Figuring Demand Ratings for Ranges

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will figure demand ratings for ranges.

REFERENCE: Electrical Trades I/Student Information Sheet/Ranges/Assignment Sheet/Figuring Demand Ratings for Ranges

DIRECTIONS: Complete the practice below.

1. Figure the demand for 16.7kw range.

2. Figure the demand for 14kw range.

3. Figure the demand for 11kw range.

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STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Planning the Job

TOPIC: Dryers and Household Appliances

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate an understanding of how to figure the demand load for dryers and household appliances.

DEMAND LOAD FOR CLOTHES DRYERS 220-18

Our residence has 7,400 watts. This rating is larger than the 5,000 minimum.

So, we use 5,000 watts.

DEMAND FOR HOUSEHOLD APPLIANCES

Use the name plate ratings of household (fixed) appliances.

Code 220-17 allows a deration of the name plate rating if there are 4 or more (fixed) appliances. Exception - This shall not apply to electric ranges, clothes dryers, space heaters or air conditioning equipment.

Example: dishwasher 8 amps x 120v = 960 watts or if 4 or more (fixed appliances

1 dishwasher 8 amps x 120 x .75 = 720 w
2 garage door openers 5 amps x 120 x .75 = 900w
1 compactor 5 amps x 120 x .75 = 450w

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Planning the Job

TOPIC: Figuring Demand Ratings for Dryers and Household Appliances

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will figure demand ratings for dryers and household appliances.

REFERENCE: Electrical Trades I/Student Information Sheet/Dryers and Household Appliances/Assignment Sheet/Figuring Demand Ratings for Dryers and Household Appliances

DIRECTIONS: Complete the practice below.

Figure the loads for dryers:

1. 2000 watts = ________________ watts
2. 3300 watts = ________________ watts
3. 5050 watts = ________________ watts
4. 8000 watts = ________________ watts

Figure the loads for appliances:

House 1

5. Dishwasher 7.8 amps = ________________ watts
6. Compactor 9 amps = ________________ watts
7. Garage door opener 12 amps = ________________ watts
8. Microwave 16 amps = ________________ watts

House 2

9. Dishwasher 6 amps = ____________________ watts

10. Microwave 11 amps = ____________________ watts

11. Garbage disposal 4 =amps ____________________ watts

House 3

12. 1 AC unit 28 amps 120 volts = ____________________ watts

13. 2 garage door openers 7 amps = ____________________ watts

14. 1 dishwasher 12 amps = ____________________ watts

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STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Planning the Job

TOPIC: Water Heaters, Air Conditioning and Heating Units

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate an understanding of how to figure the demand load for water heaters, air conditioning and heating units.

Figure loads for water heaters.

NEC 422-14b tells us that for storage tank water heaters we must use 125 percent of name plate ratings.

Example: WH ratings 22 amps 40 gallons 240 volts.
22 amps x 240 volts x 1.25 = 6,600 watts

Figure loads for AC and heating units.

Example: AC unit - 34 amps x 240v = 8,160 watts
Heater unit - 63 amps x 240v = 15,120 watts

We can take away the smaller 8,160 watts and only need to figure 15,120 watts.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Planning the Job

TOPIC: Residential Dwelling Demands

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate an understanding of how to figure the demand for a residential dwelling.

DWELLING DEMAND LOADS

Some other codes to keep in mind are:

Section 220-10b

Continuous loads, loads that will stay on for 3 hours or more, shall be figured at 125 percent.

Section 220-22

When figuring loads for neutral wires remember: for electric ranges, wall mounted ovens, counter-mounted cook tops and electric dryers, the maximum unbalanced load shall be considered 70 percent of the load on the un-grounded conductors as determined by Tables 220-19. There shall be a further demand factor of 70 percent permitted for that portion of the unbalanced load in excess of 200 amperes.

Example:

Range with rating of 15.5kw	Phase load	Neutral load
8,000 x 1.2 = 9,600 watts divided by 240	40 amps	40 amps

Example:

If you add up all of the neutral column and it exceeds 200 amps, then you can take 70 percent of that remainder.

Total neutral load 250 amps

-200

50 amps x .70 = 35 amps

200 amps + 35 = 235 amps

Section 430-24

To determine demand load with motors, we must take the largest motor load and multiply it by 25 percent to get an additional start up load.

Example:

General lighting	25 amps
Dryer	30.8 amps
AC unit	32 amps
Garage door opener	5 amps
Largest motor 32 x .25	8 amps

Now let's look at all of these figures put together on a table.

DEMAND LOAD IN TABLE FORM

Known values
120/240v single phase 3 wire
2,360 sq. ft.
Residence has
1 - 15l5 kw range 120/240 volt
1 - 7,400 watt dryer 120/240 volt
1 - 4.8 amp dishwasher 120 volt
2 - 1.650 watt space heaters 120 volt
1 - 6,400 watt 45 gallon water heater
1 - 22.5 amp air conditioning unit 240 volt

UNIT	LOAD IN WATTS	DIVISOR FACTOR	EACH PHASE	NEUTRAL LOAD
General Lighting	6,003 watts	240v	25a	25a
Range	9,600 watts	240v	40a	28a
Dryer	7,400 watts	240v	30.8a	21.5a
Dish-washer	4.8amp x 120v = 576w	240v	2.4a	2.4a
Space Heater	2 x 1,650 = 3,300w	240v	13.7a	13.7a
Water Heater	6,400w x 1.25 = 8,000w	240v	33.3a	---
AC	22.5 amp x 240v = 5,400w	240v	22.5a	---
25% of largest motor load	22.5 x 240v x .25 - 1,350	2.40v	5.6a	
			159.6a	90.6a

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________ **DATE:** ______________________

UNIT: Planning the Job

TOPIC: Figuring Demand Ratings for a Single Family Dwelling

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to plan a residential electrical service entrance and individual and general purpose branch circuits.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will figure demand ratings for a single family dwelling.

REFERENCE: Electrical Trades I/Student Information Sheet/Residential Dwelling Demands/Assignment Sheet/Figuring Demand Ratings for a Single Family Dwelling

DIRECTIONS: Complete the practice below.

Known: 120/240 volt single phase 3 wire 2,000 square feet.

Residence has

1 - 13.6kw range 120/240 volt
1 - 4,000 watt dryer 120/240 volt
1 - dishwasher 7.4 amps 120 volt
1 - AC unit 23 amps 240 volt
1 - heating unit 60 amps 240 volt
1 - garbage disposal 4 amps 120 volts
1 - trash compactor 8 amps 120 volt
1 - garage door opener 6 amps 120 volt

UNIT X

ELECTRICAL INSTALLATION

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Electrical Installation

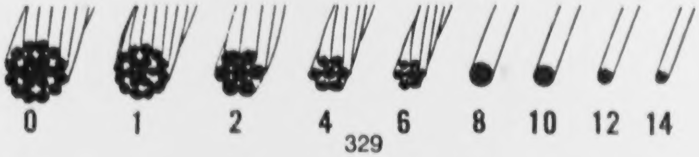
TOPIC: Terms and Definitions for Electrical Installation

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to identify terms and definitions associated with electrical wiring procedures.

1. **Branch circuit**--all the outlets and receptacles connected on any one breaker and commonly called a "leg"
2. **Cord**--several small wires put together in an insulating cover; usually very flexible
3. **Duplex receptacle**--a contact device that is installed at an outlet for connection of two single plugs
4. **Electrical cable**--two or more wires put together inside an insulating cover
5. **Ground wire**--usually bare or green wire that connects circuit to earth for safety
6. **Hot wire**--usually black but can be any color except green; always has voltage applied to it
7. **Junction box**--a covered outlet box used to enclose splices within a circuit
8. **Neutral wire**--usually white or gray; serves as a return for current
9. **Outlet box**--a box used to bring the wires to a switch, receptacle, or light
10. **Single pole switch**--a switch that controls only one side of the line
11. **Terminal**--a connection between the wires and electrical devices usually fastened with a screw or clip
12. **Three-way switch**--a switch to control a circuit from two places
13. **Wire**--a single conductor
14. **Wire gauge number**--the number that determines the size of the wire from 4/0 to 14

    (NOTE: The smaller the number, the larger the wire diameter.)



15. **Wire size**--measure of wire diameter; called the "gauge" of wire

16. **Wiring plan**--a drawing of the house floor plan showing wiring, switches, and outlet locations.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Electrical Installation

TOPIC: Terms and Definitions for Electrical Installation

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate the ability to identify terms and definitions associated with electrical wiring procedures.

REFERENCE: Student Information Sheet/Terms and Definitions for Electrical Installation

DIRECTIONS: Using the chart provided, change each number to a letter of the alphabet in order to complete each statement.

1 = A
2 = B
3 = C
4 = D
5 = E
6 = F
7 = G
8 = H
9 = I
10 = J
11 = K
12 = L
13 = M
14 = N
15 = O
16 = P
17 = Q
18 = R
19 = S
20 = T
21 = U
22 = V
23 = W
24 = X
25 = Y
26 = Z

1. A ___ ___ ___ ___ is a single conductor.
   23 9 18 5

2. An ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ is made up of two or more
   5 12 5 3 20 18 9 3 1 12 3 1 2 12 6
   wires put together inside an insulating cover.

3. Several small wires put together in an insulating cover, usually very flexible is called a
   ___ ___ ___ ___.
   3 15 18 4

4. The ___ ___ ___ ___ ___ ___ ___ ___ is the measure of wire diameter; this is called the
   23 9 18 5 19 9 26 5
   "gauge" of the wire.

5. The ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ is the number that
   23 9 18 5 7 1 21 7 5 14 21 13 3 5 18
   determines the size of the wire from 4/0 to 14.

6. A ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ is usually bare or green wire that connects circuit
   7 18 15 21 14 4 23 9 18 5
   to earth for safety.

ELECTRICAL INSTALLATION

7. The ___ ___ ___   ___ ___ ___ ___ is usually black but can be any color except green and
8 15 20   23 9 18 5
always has voltage applied to it.

8. The ___ ___ ___ ___ ___ ___ ___   ___ ___ ___ ___ is usually white or gray and serves as a
14 5 21 20 18 1 12   23 9 18 5
return current.

9. The ___ ___ ___ ___ ___ ___ ___ ___   ___ ___ ___ is a covered box used to enclose splices
10 21 14 3 20 9 15 14   2 15 24
within a circuit.

10. An ___ ___ ___ ___ ___ ___   ___ ___ ___ is a box used to bring the wires to a switch,
15 21 20 12 5 20   2 15 24
receptacle, or light.

11. A ___ ___ ___ ___ ___ ___ ___ ___ is a connection between the wires and electrical devices
20 5 18 13 9 14 1 12
usually fastened with a screw.

12. A ___ ___ ___ ___ ___ ___   ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ is a contact device that
4 21 16 12 5 24   18 5 3 5 16 20 1 3 12 5
is installed at an outlet for connection of two single plugs.

13. A ___ ___ ___ ___ ___ ___   ___ ___ ___ ___   ___ ___ ___ ___ ___ ___ is a switch that
19 9 14 7 12 5   16 15 12 5   19 23 9 20 3 8
controls only one side of the line.

14. A ___ ___ ___ ___ ___ ___ ___ ___   ___ ___ ___ ___ ___ ___ is a switch used to control a
20 8 18 5 5 23 1 25   19 23 9 20 3 8
circuit from two places.

15. A ___ ___ ___ ___ ___ ___   ___ ___ ___ ___ is a drawing of the house floor plan showing
23 9 18 9 14 7   16 12 1 14
wiring, switches, and outlet locations.

16. A ___ ___ ___ ___ ___ ___   ___ ___ ___ ___ ___ ___ ___ includes all outlets and receptacles
2 18 1 14 3 8   3 9 18 3 21 9 21
connected on any one breaker and is commonly called a leg.

LP-X-2
LP-X-3
LP-X-4
LP-X-5
LP-X-6
LP-X-7
LP-X-8
LP-X-9
LP-X-10

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Electrical Installation

TOPIC: Connectors

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to identify and properly install various connectors.

As electrical splices and electrical connections are the troublemakers and weak points in an electrical circuit or electrical system extreme care must be taken in making them. The two primary considerations to be observed when making electrical splices and electrical connections are that they must be mechanically secure and electrically secure. Therefore, making good electrical splices and good electrical connections are the most important things that new electricians must learn.

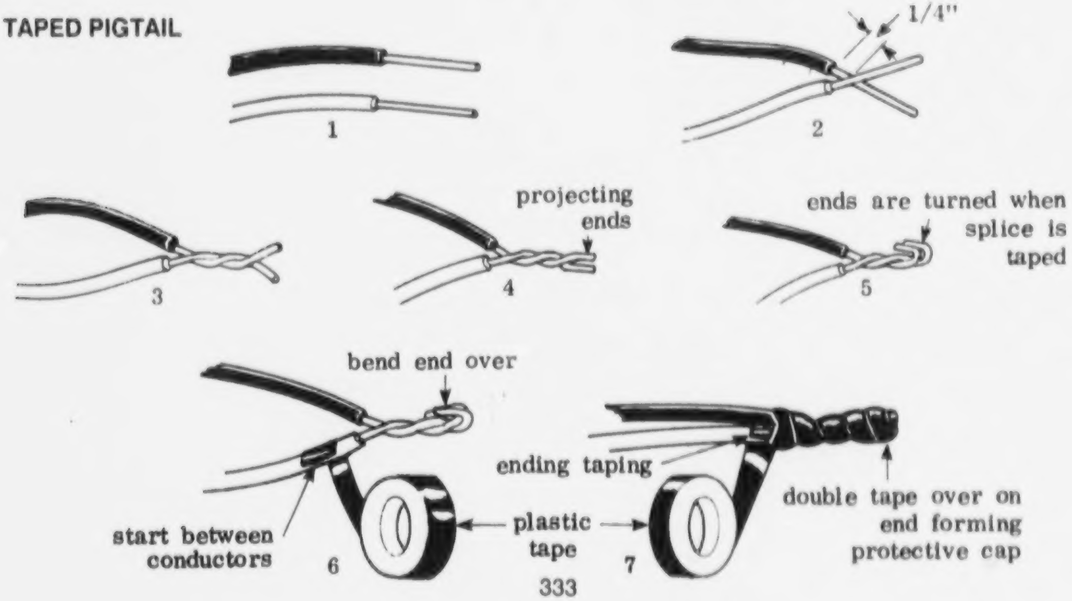
TYPES OF SPLICES

Electrical Splice: Joining the ends of two wires or cables either by mechanically twisting them together or by using a special splicing device.

Pigtail Splice: Three types - taped, two wire solderless, multiple wire solderless.

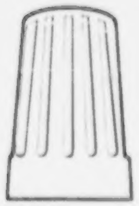
The pigtail splice is the simplest to make. Therefore, it is very likely that it is the most often used electrical splice.

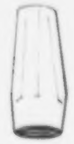
TAPED PIGTAIL


1/4"
1
2
3
projecting ends
4
ends are turned when splice is taped
5
bend end over
ending taping
start between conductors
6
plastic tape
7
double tape over on end forming protective cap

1. Insulation is removed from both wires back an equal distance from the ends, approximately one inch.
2. Cross the wires approximately 1/3" from the end of the insulation.
3. Hold the wires in position with the thumb and fingers of one hand and using pliers in the other hand twist the ends together firmly for approximately six turns. This insures that wires are fastened together properly.
4. After the wires are twisted together there will be protruding ends.
5. Before splice is taped the projecting ends are turned back to prevent them from protruding through the tape.
6. This illustrates the usual method for starting the tape on a splice.
7. Taping is necessary to prevent oxidation of the splice, as well as shocking, and possibly shorting out. The tape is to provide as much insulation as the original insulation. One wrap will take care of voltage up to 600 volts, but in order to obtain good mechanical protection two or more wraps are necessary. Plastic tape is stretched as it is applied in order to secure the tape more firmly.

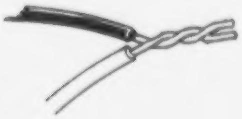
WIRE NUTS

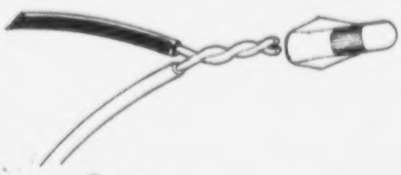




Also known as a solderless connector. These connectors can be purchased in different colors for coding such as yellow, red, gray, and blue. These connectors have almost completely replaced soldered and taped splices of some types. Solderless connectors are selected for size depending upon the size wire to be joined and the number of wires to be joined. They are used a great deal for electrical splices in outlets and junction boxes. The wire nut has a spring inside and as it is screwed onto the splice it holds the spliced wires more firmly together.

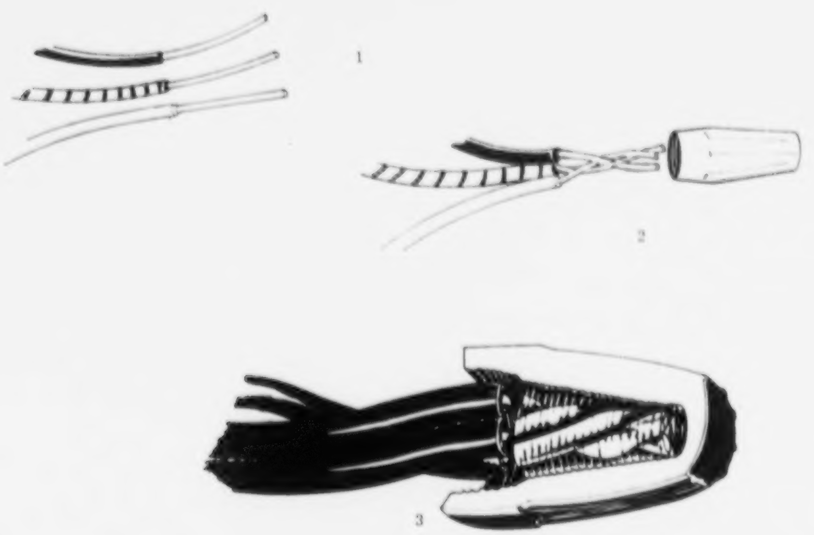
WIRE NUT SPLICE





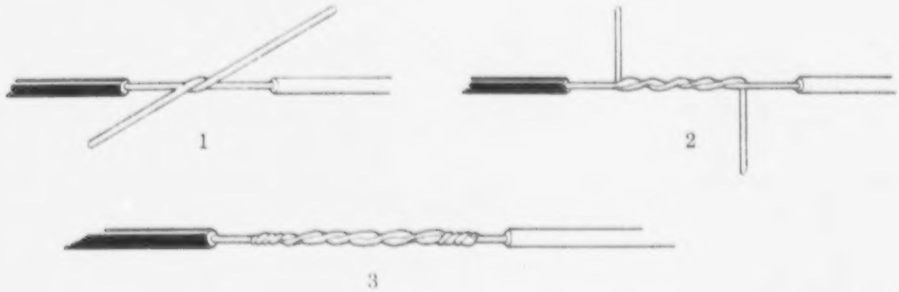
1. The wire nut pigtail splice is prepared exactly like the taped pigtail up to the final step.
2. The final step consists of cutting off the projecting ends and installing the wire nut or solderless connector.

MULTIPLE-WIRE PIGTAIL SPLICE



1. Depending on the size of the wires to be spliced remove insulation.
2. Twist the wires together securely; this will insure that all wires are properly fastened together.
3. Ends of wires are clipped and the insulated cap is firmly installed. Make sure that the bottom end of the cap fully covers the insulated area of the wires.

WESTERN UNION SPLICE

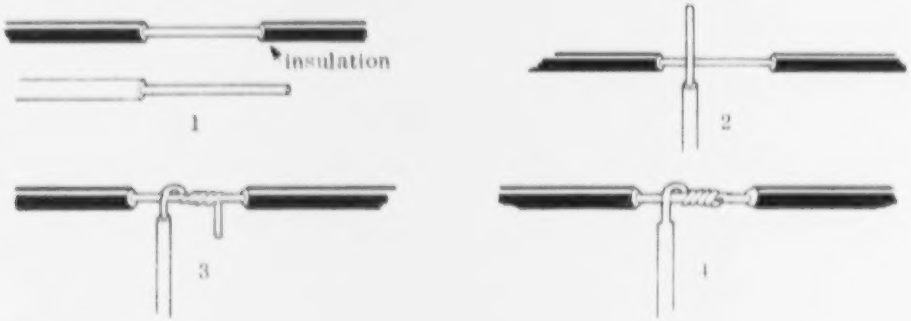


The Western Union splice is used when solid conductors must carry their own weight for a considerable span or when the conductors are too large for a pigtail splice. Also, the Western Union splice is used for mechanical efficiency such as where a substantial amount of strain is placed on the connection.

A Western Union splice is prepared by:

1. Removing the insulation from the wires back a distance from the ends depending on their size. The removal of insulation varies from about 3" for no. 14 AWG to approximately 6" for no. 10. The wires are then crossed at their midpoints.
2. The ends are then twisted in opposite directions from four to six turns.
3. The ends are then twisted at a right angle to the run of the splice for three full turns. Carefully cut off the excess ends removing any sharp edges.

TEE TAP SPLICE (T - TAP)

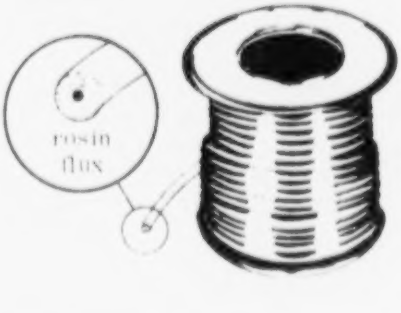


The tee tap splice is used to connect one wire to a continuous run of another wire. It is made without having to cut the continuous run or main line. It is somewhat more difficult to make than other types of splices; therefore, it may take an amount of practice to prepare a neat looking mechanically sound tee tap splice.

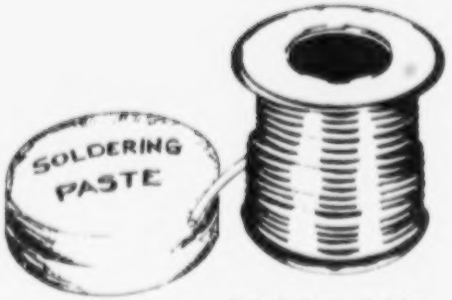
As an example, the tee tap splice is to be made using no. 14 wire.

1. For the tee tap splice insulation on no. 14 wire: Tap wire insulation is removed back from the end for approximately 2", and the ongoing run wire insulation is removed for approximately a distance of 1 1/4".
2. The wires are crossed with the tap wire 1/4" from the insulation at the left on the run wire. The tap wire insulation is to clear the run wire by 1/4".
3. The tap wire is twisted around the run wire drawing each turn tight by using pliers. Make four to five turns with the tap wire. Trim the end leaving no sharp edges.

SOLDER EQUIPMENT AND SUPPLIES



Rosin Core Solder



Solid Core Solder

Soldering Paste

SOLDER

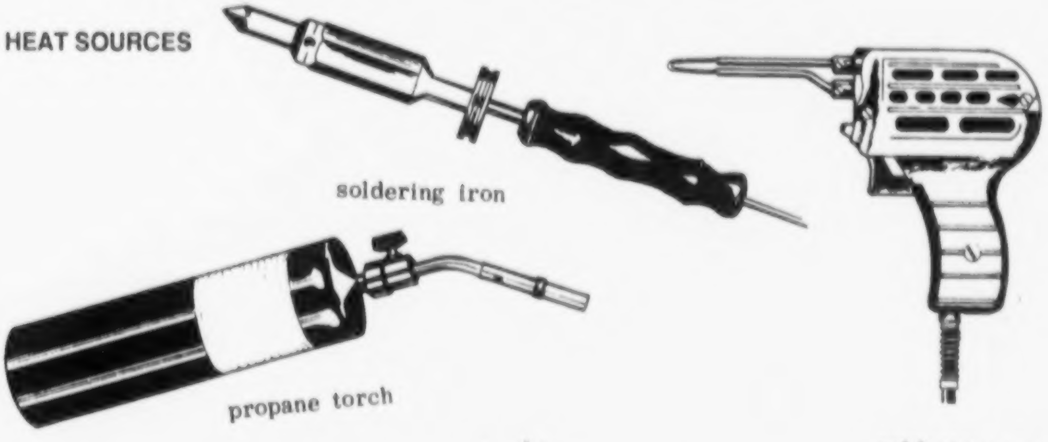
Solder used for electrical work is an alloy of tin and lead. The tin in the solder is for strength and the lead content determines the solder melting point. Various combinations of these metals can be obtained; however, the two most commonly used are 50/50 grade and 60/40. The 50% tin and 50% lead requires less heat for melting, but it makes a stronger joint.

The most common types of solder are rosin core, solid, and acid core. Acid core is not to be used for electrical work as it will corrode the connection.

Rosin core solder has the flux in the hollow core of the string. For most small jobs the rosin core solder is preferred because of the ever present flux.

Solid core solder contains no flux. A cleaning flux must be used with it.

HEAT SOURCES



soldering iron

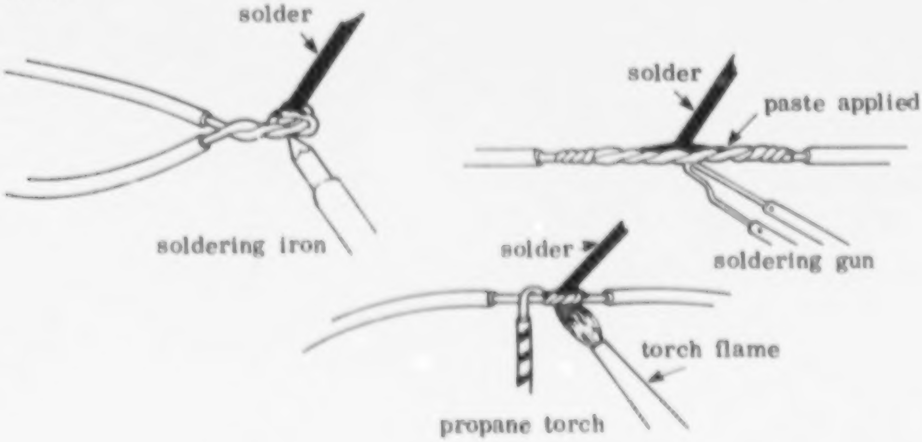
propane torch

soldering gun

ELECTRICAL INSTALLATION

In order to solder there must be heat applied. This heat can be provided by any one of three ways: soldering iron, soldering gun, or propane torch. When electric power is not available the propane torch is used or when the wires are large.

SOLDER SPLICES



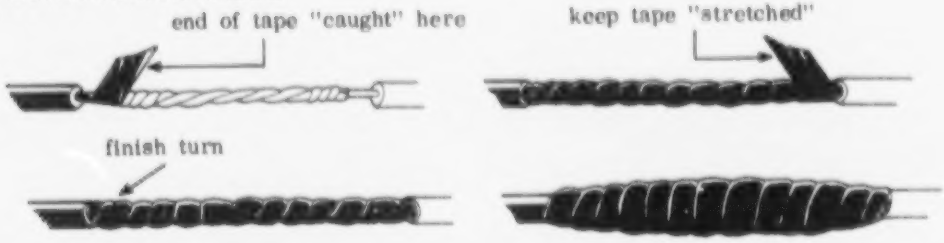
Soldering is the most reliable method of joining wires. It does require a certain amount of skill; therefore, practice is necessary. A good solder joint requires a clean metal surface free of foreign particles of dirt, grease, oil, and rust. Thus when an area to be soldered has been stripped of insulation and the splice made, it should be soldered as soon as practical, reducing the chance of collecting foreign particles and oxidation which reduces the chances of getting a good solder job.

Cleaning a splice is accomplished by using fine sandpaper, emery cloth, or fluxing it as it is heated. The cleaner a splice the better solder will flow around it.

Heat is always applied from the bottom side or opposite side of a splice from which the solder is applied. Melting solder flows toward heat. If the top of the splice is hot enough to melt the solder the hotter bottom side will draw the solder down through all the cracks, crevices, and holes in the splice.

A soldered splice is allowed to cool naturally; also, keep from moving the soldered splice. Soldered splices are not to be quenched with water or blown on to cool them. Fast cooling of a soldered splice removes all the strength from the solder and the splice is then mechanically unsound.

TAPE WESTERN UNION SPLICE



6[illegible]9

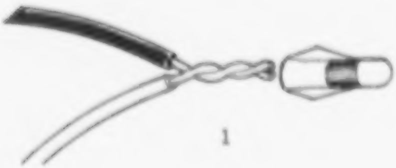
Taping of splices can be done by either one of two accepted methods. The purpose of taping is to insulate the splice by covering it with protective material which provides approximately the same electrical strength as the insulation on the original wire. One method of taping is with rubber and friction tape. This is a good method but time consuming, more expensive, and more bulky. Therefore, in recent years plastic tape has come into general use because of its laborsaving and being less bulky.

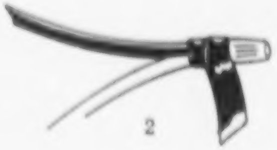
1. Start tape at left end of splice making one turn securing tape. Maintain a pull which will stretch the tape.
2. Wrap the splice to the right in a diagonal pattern keeping the tape stretched. Overlap each preceding turn by one-half the width of the tape.
3. Reverse the direction of travel at the right end of the splice. Continue wrapping the second layer until it is completed.
4. Overlap the tape one-half its width over the left side insulation and wrap back to the right covering the right side insulation by one-half the width of the tape.

Cut off excess tape and pinch ends against the splice. Remember to keep tape stretched at all times which secures the tape more firmly.

SOLDERLESS CONNECTORS

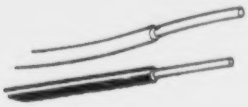
PLASTIC CAP - Same Gauge and Typewire


1

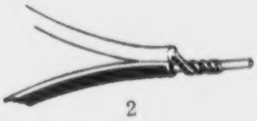

2

1. Wires are stripped, twisted, and cap slipped over connection.
2. Connection is taped by lapping tape over insulation one-half width of tape. Make one loop stretching tape tight. Make diagonal loops covering each loop with one-half width of tape. Tape to center of plastic.

PLASTIC CAP - DIFFERENT GAUGE AND TYPEWIRE



1



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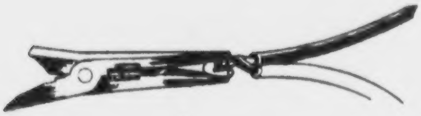

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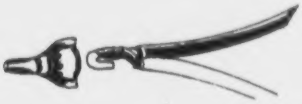
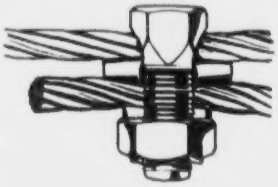


4

This type electrical connection is very similar to the same size and type wire connection; however, there is some slight difference.

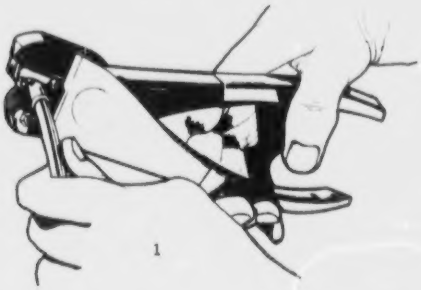
1. Insulation is removed according to size of wires, stranded and solid.
2. The stranded wire is then twisted around the solid wire leaving an exposed end of the solid wire.
3. The exposed end of the solid wire is then bent back over the stranded wire.
4. A plastic cap is then fitted over the connection.

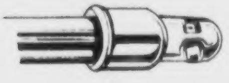
SPLIT BOLT CONNECTOR



This mechanical connector is used to join cables of large size such as service entrance and the like. The split bolt has a floating separator. This is to keep the cables separated for more secure tightening. The nut and separator are removed from the bolt. The bolt is then slipped over one cable and separator is then inserted. The split bolt is then slipped over the second cable and the nut finger tightened on the bolt. Two wrenches of the correct size are then used to pull the nut down attaching the two ends of the cable securely.

CRIMP - TYPE CONNECTORS


1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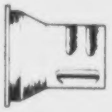
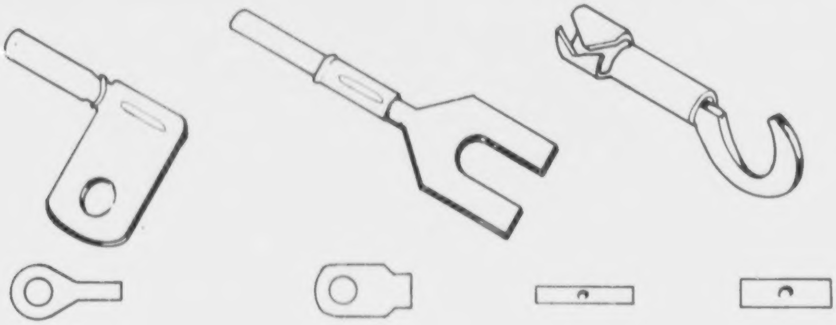

3

To install this connector:

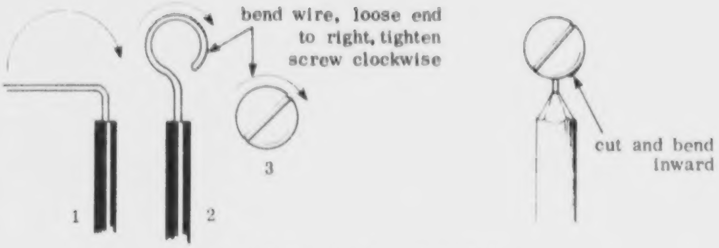
1. The wires are first stripped and twisted together. The metal cap is then slipped over the wires. A crimping plier is used to crimp wires and thimble together.
2. Figure 2 shows the crimp marks made in the thimble and the three parts firmly locked together.
3. The connection at this point can be taped or a vinyl insulating cap can be slipped over the metal thimble.

NON-INSULATED TERMINALS



The insulated connectors are used essentially the same as the non-insulated. However, they can be used in places where otherwise there would be a chance for a short. Figures 1 and 2 show a type connector with the ends turned at a right angle. This helps to lock the connector in position and will withstand a certain amount of strain or pull from the wire. Figures 3 and 4 show the male and female connectors for a quick couple. Figure 5 is the insulated example of a line connector.

SCREW TERMINALS



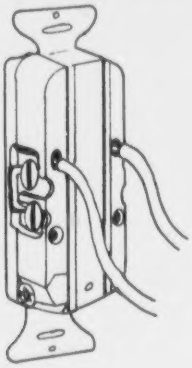
correct method for wire loop installation

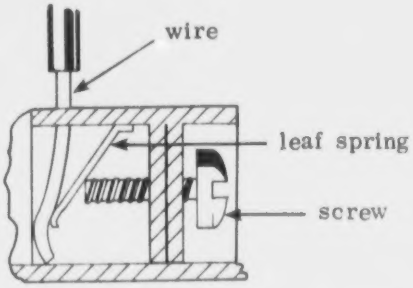
Screw type terminals provide an electrically - mechanically secure connection. In order for this connection to make up properly, however, the wire must be bent and secured with the screw.

1. The insulation is stripped and the naked wire bent to the left.
2. Using needle nose pliers a near perfect loop is made in the naked wire just larger than the screw over which it is to fit.
3. The wire may be installed on the screw one of two ways:
   a. The loop is not closed and the open end to the right. Slide the loop under the head of the loosened screw. Cut off excess end of wire. Bend end inward, under screw head if possible. Tighten screw firmly.
   b. Close the loop, remove screw, with the openend of loop to the right, insert the screw through loop, tighten the screw securely.

NOTE: Make sure wire end is looped.
Make sure wire end is not too long.
Make sure loose end of wire is under screw head.

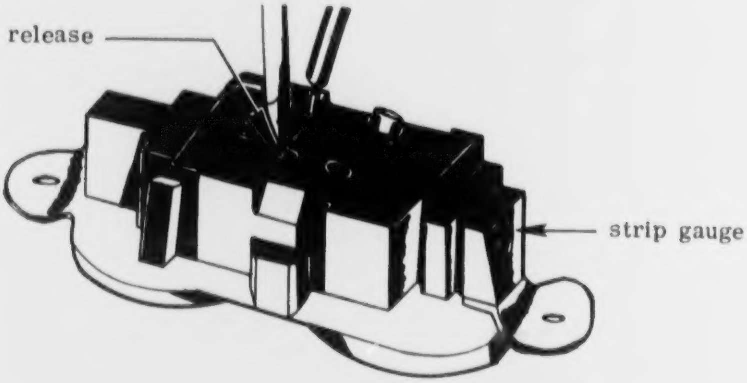
BACK - WIRED QUICK CONNECTORS





The set screw type is used by first loosening the set screw, and the skinned wire end is pushed through a hole and behind the spring. Tension is then placed on the spring, which holds the wire in place, by the set screw. To remove the wire the procedure is reversed.

SPRING TYPE



The spring type Back Wired Connector has leaf springs or pressure plates which are actuated by coil springs to hold the conductor wires in place.

On one end of the electrical equipment there is a gauge for the technician to use for determining the amount of insulation to be stripped from the wire.

Circuit wires are inserted into the electrical equipment through holes in the backside.

The conductors are released by inserting a screwdriver or stiff wire into the actuating spring opening next to the particular wire or wires to be removed and pressing down.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:________________________________ **DATE:**________________________

UNIT: Electrical Installation

TOPIC: Connectors

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate the ability to identify and properly install various connectors.

REFERENCE: Student Information Sheet/Connectors

DIRECTIONS: Below are questions that are to be answered in complete sentences and in as few words as possible. The assignment is designed to include correct spelling and use of the correct trade terms.

1. What are the weak points in an electrical system?

2. What are the primary considerations to be observed when making an electrical splice or electrical connection?

3. Define electrical splice.

4. What are the types of "Pigtail" splices?

5. Why is it necessary to tape a splice?

6. Up to what voltage will one wrap of plastic tape take care of?

7. Why stretch plastic insulation tape as it is applied?

8. Where in an electrical system are wire nuts (solderless connectors) most commonly used?

9. How are wire nuts selected for the job?

10. What are the existing conditions under which an electrical system requires that a "Western Union" splice be used?

11. For what purpose or purposes are "Tee" splices used?

12. What does the expression 60/40 mean, when referring to solder?

13. What is the purpose of the tin content in solder?

14. What are the sources of heat for soldering splices?

15. Why is the source of heat for soldering a splice applied to the opposite side away from the solder?

16. What are the methods used for cleaning a splice prior to soldering?

17. What is the effect of cooling a solder joint too rapidly?

18. For what is a split bolt connector usually used?

19. What is a crimp type connector?

20. When are "Non-Insulated" Terminals used?

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Electrical Installation

NAME OF JOB: Connectors/Taped Pigtail

UNIT OBJECTIVE: After completing this unit, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and properly install various connectors.

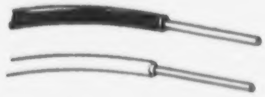
TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool

MATERIALS: 2 pieces of wire 12" in length, electrical tape

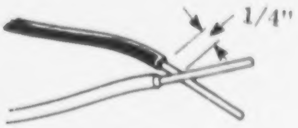
GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

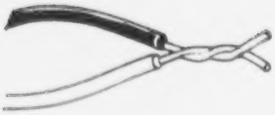
1. Using the multipurpose tool remove one inch of insulation from one end of each of the wires.

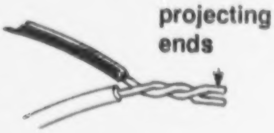


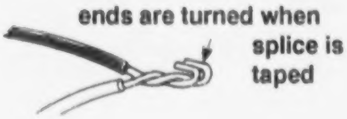
2. Cross the wires approximately 1/4" from the end of the insulation.



3. Hold the wires in position with thumb and fingers of one hand and using pliers in the other hand twist the ends together firmly for approximately six turns.

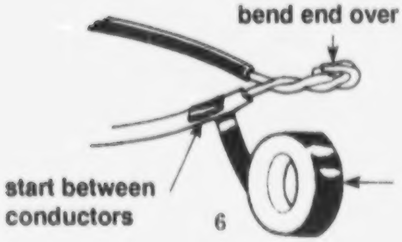


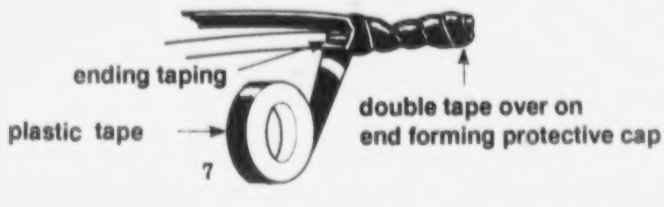




(**NOTE:** After the wires are twisted together there will be no protruding ends.)

4. Tape the splice using procedures shown below.


bend end over
start between conductors
6


ending taping
plastic tape
double tape over on end forming protective cap
7

5. Replace the tools.

6. Clean the work area.

JOB SHEET

ELECTRICAL TRADES I

NAME:____________________________ **DATE:**____________________

UNIT: Electrical Installation

NAME OF JOB: Connectors/Wire Nut Splice

UNIT OBJECTIVE: After completing this unit, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and properly install various connectors.

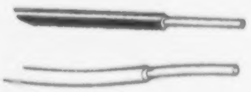
TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool

MATERIALS: 2 pieces of wire 12" in length, wire nut or solderless connector

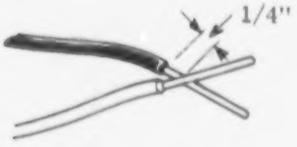
GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

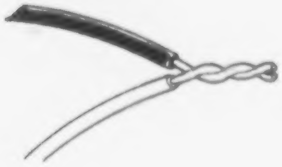
1. Using the multipurpose tool remove one inch of insulation from one end of each of the wires.

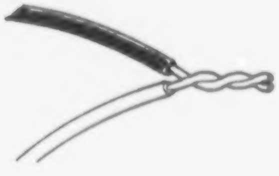


2. Cross the wires approximately 1/4" from the end of the insulation.



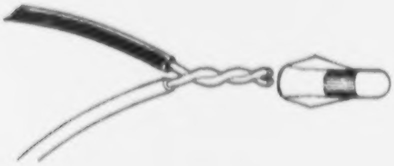
3. Hold the wires in position with thumb and fingers of one hand and using pliers in the other hand twist the ends together firmly for approximately six turns.





4. Cut off the projecting ends of the wires.

5. Install the wire nut or solderless connetor.



6. Replace the tools.

7. Clean the work area.

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**____________________

UNIT: Electrical Installation

NAME OF JOB: Connectors/Multiple-Wire Pigtail Splice

UNIT OBJECTIVE: After completing this unit, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and properly install various connectors.

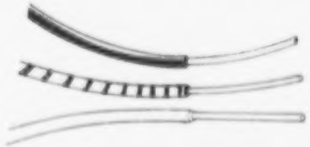
TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool

MATERIALS: 3 pieces of wire 12" in length, wire nut or solderless connector

GENERAL INSTRUCTIONS: Follow instructions given in class.

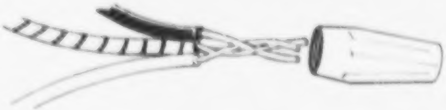
PROCEDURES AND/OR TASKS:

1. Using the multipurpose tool remove one inch of insulation from one end of each of the wires.

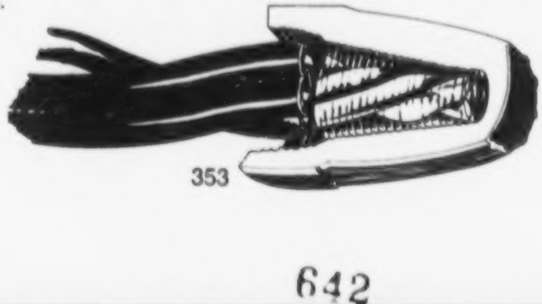


2. Twist the wires together securely using the pliers.

   (**NOTE:** This will insure that all wires are properly fastened together.



3. Clip ends of wires.
4. Install the wire nut.
5. Make sure that the bottom end of the cap fully covers the insullated area of the wires.



6. Replace the tools.
7. Clean the work area.

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**____________________

UNIT: Electrical Installation

NAME OF JOB: Connectors/Western Union Splice

UNIT OBJECTIVE: After completing this unit, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and properly install various connectors.

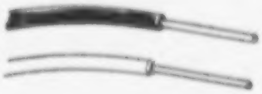
TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool

MATERIALS: 2 pieces of wire 12" in length, electrical tape

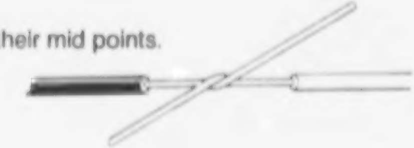
GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

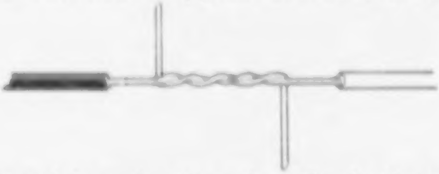
1. Using the multipurpose tool remove insulation from one end of each of the wires. Remove about 3" for no. 14 wire and about 6" for no.10 wire.



2. Cross the wires at their mid points.



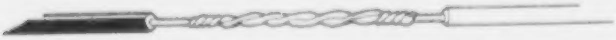
3. Twist the ends of the wires in opposite directions for from four to six turns.



4. Twist the ends at right angles to run the splice for three full turns.

ELECTRICAL INSTALLATION

5. Carefully cut off the excess ends removing any sharp edges.



6. Replace the tools.

7. Clean the work area.

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Electrical Installation

NAME OF JOB: Connectors/Tape Western Union Splice

UNIT OBJECTIVE: After completing this unit, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and properly install various connectors.

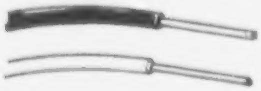
TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool

MATERIALS: 2 pieces of wire 12" in length, electrical tape

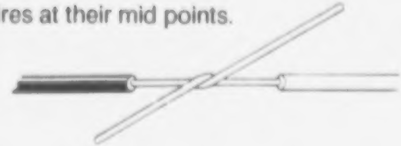
GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

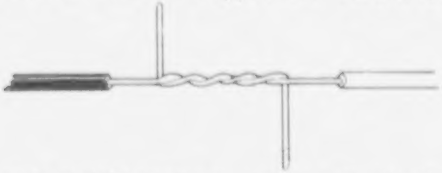
1. Using the multipurpose tool remove insulation from one end of each of the wires. Remove about 3" for no. 14 wire and about 6" for no.10 wire.



2. Cross the wires at their mid points.

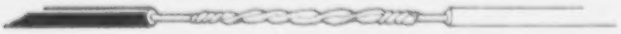


3. Twist the ends of the wires in opposite directions for from four to six turns.

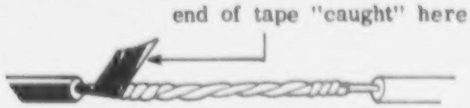


4. Twist the ends at right angles to run the splice for three full turns.

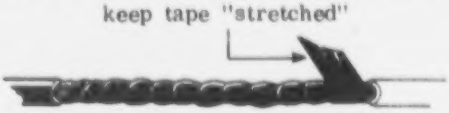
5. Carefully cut off the excess ends removing any sharp edges.



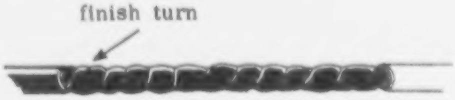
6. Start tape at the left end of the splice making one turn securing the tape.



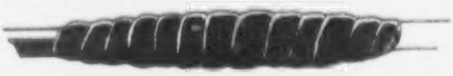
7. Wrap the splice to the right in a diagnoal pattern keeping the tape stretched. Overlap each preceding turn by one-half the width of the tape.



8. Reverse the direction of travel at the right end of the splice. Continue wrapping the second layer until it is completed.



9. Overlap the tape one-half its width over the left side of insulation and wrap back to the right covering the right side of insulation by one-half the width of the tape.



10. Cut off excess tape and pinch ends against the splice.

    (**NOTE:** Remember to keep the tape stretched at all times.)

11. Replace the tools.

12. Clean the work area.

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JOB SHEET

ELECTRICAL TRADES I

NAME: ____________________ **DATE:** ____________________

UNIT: Electrical Installation

NAME OF JOB: Connectors/Tee Tap Splice (T-TAP)

UNIT OBJECTIVE: After completing this unit, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and properly install various connectors.

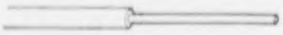
TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool

MATERIALS: 2 pieces of no. 14 wire 12" in length, electrical tape

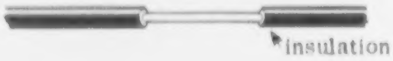
GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

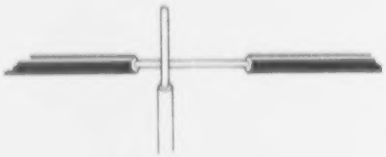
1. Using the multipurpose tool remove two inches of insulation from one end of one wire. This is the tap wire.



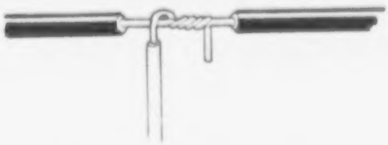
2. Remove 1 and 1/4" of insulation from the middle of the other wire. This is the run wire.

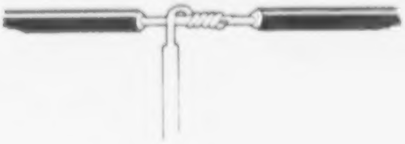


3. Cross the wires with the tap wire 1/4" from the insulation at the left on the run wire.



4. Twist the tap wire around the run wire drawing each turn tight by using pliers. Make four or five turns with the tap wire.





5. Trim the ends leaving no sharp edges.

6. Replace the tools.

7. Clean the work area.

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Electrical Installation

NAME OF JOB: Connectors/Crimp-Type

UNIT OBJECTIVE: After completing this unit, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and properly install various connectors.

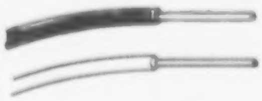
TOOLS AND EQUIPMENT: Pliers, knife, multipurpose tool, crimping plier

MATERIALS: 2 pieces of wire 12" in length, metal cap (thimble)

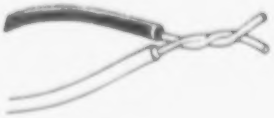
GENERAL INSTRUCTIONS: Follow instructions given in class.

PROCEDURES AND/OR TASKS:

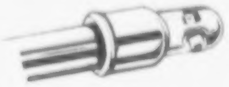
1. Using the multipurpose tool remove insulation from one end of each of the wires.



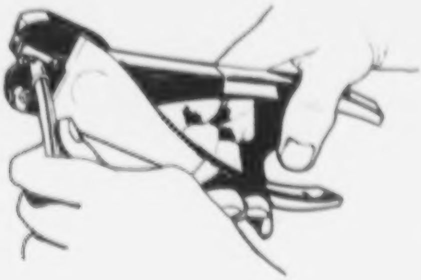
2. Twist ends of wires together.



3. Slip the metal cap over the wires.



4. Use the crimping pliers to crimp wires and thimble together.



5. Replace the tools.

6. Clean the work area.

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**____________________

UNIT: Electrical Installation

NAME OF JOB: Connectors/Screw Terminals

UNIT OBJECTIVE: After completing this unit, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and properly install various connectors.

TOOLS AND EQUIPMENT: Needle nose pliers, knife, multipurpose tool, screwdriver

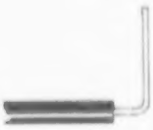
MATERIALS: 1 pieces of wire 12" in length, screw type terminal

GENERAL INSTRUCTIONS: Follow instructions given in class.

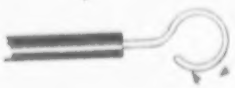
PROCEDURES AND/OR TASKS:

1. Using the multipurpose tool remove insulation from one end of the wire.

2. Bend the naked wire to the left.

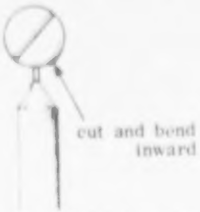


3. Using the needle nose pliers make a near perfect loop just larger than the screw over which it is to fit.



4. Install the wire by one of the following methods:

   a. The loop is not closed and the open end to the right. Slide the loop under the head of the loosened screw. Cut off excess end of wire. Bend end inward, under screw head if possible. Tighten the screw firmly.



   b. Close the loop, remove the screw, insert the screw through the loop with the end of the wire to the right, tighten the screw securely.

5. Replace the tools.

6. Clean the work area.

LP-X-11
LP-X-12
LP-X-13
LP-X-14
LP-X-15

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Electrical Installation

TOPIC: Learning About Conductors

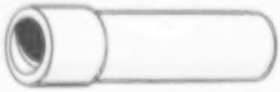
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to identify and properly install various conductors.

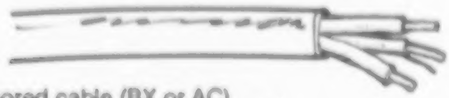
Webster's gives the definition of conductor as "a substance or body capable of transmitting electricity, heat, or sound." In electrical trades, conducting material for carrying electricity is called wiring. Conductors carry current from one point to another in a circuit. One conductor wire is known as the **hot wire**, this wire carries current. A second wire is termed the **neutral wire**, this wire completes the circuit. If a third wire is present it is the **ground**.

Conductors differ in size and in the way in which they are insulated and/or protected. The ones most commonly used are:

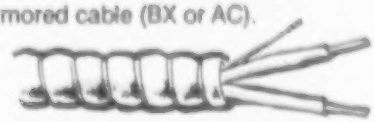
1. Nonmetallic conduit (PVC).



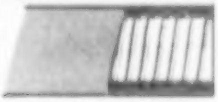
2. Nonmetallic sheathed cable (NM, NMC, VF, and USE).



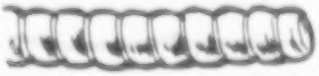
3. Armored cable (BX or AC).



4. Liquid-tight flexible metal conduit (LTFMC).



5. Flexible metal conduit (Greenfield).



6. Thin-walled conduit known as electrical metallic tubing (EMT).

7. Intermediate metal conduit (IMC).

8. Rigid metal conduit.

Most of the types of conductors listed above will meet the needs of most wiring situations. However, some cannot be used where there are unusual hazards such as extreme moisture, explosive gases, etc.

The type of conductor selected will depend on variables such as the type of dwelling, type of materials and construction, where the dwelling is located, cost of electrical materials, preference of contractor and/or client, and local county, state, and NEC requirements.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT:	Electrical Installation
TOPIC:	Learning About Conductors
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate the ability to identify various electrical conductors.
REFERENCE:	Student Information Sheet/Learning About Conductors
DIRECTIONS:	Your instructor will make a display of conductors used in electrical trades. Each conductor will be assigned a number. On a sheet of paper write the correct name for each conductor beside the number.

LP-X-12

JOB SHEET

ELECTRICAL TRADES I

NAME: ______________________ **DATE:** ______________________

UNIT: Electrical Installation

NAME OF JOB: Conductors/Rigid Metal Conduit

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and properly install rigid metal conduit.

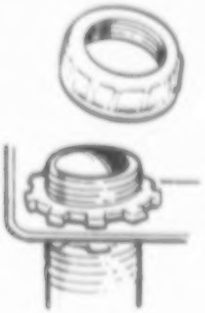
TOOLS AND EQUIPMENT: Hacksaw, pipe threader, reamer, pliers

MATERIALS: 1' of rigid conduit, electrical outlet box, locknut and bushing

GENERAL INSTRUCTIONS: Using safety procedures, follow the procedures given below. Ask your instructor for assistance as needed.

PROCEDURES AND/OR TASKS:

1. Using the hacksaw, cut the conduit to a length of 10".
2. Use the pipe threader to thread the end of the conduit.
3. Using the reamer, remove any burrs.
4. Install the conduit into the outlet box using the locknut and bushing.
5. Have your instructor check your work.
6. Replace the tools.
7. Clean the work area.



JOB SHEET

ELECTRICAL TRADES I

NAME:____________________________ **DATE:**____________ ____________

UNIT: Electrical Installation

NAME OF JOB: Conductors/Intermediate Metal Conduit

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and properly install intermediate metal conduit.

TOOLS AND EQUIPMENT: Hacksaw, pliers, screwdriver

MATERIALS: 1' of intermediate conduit, electrical outlet box, connector

GENERAL INSTRUCTIONS: Using safety procedures, follow the procedures given below. Ask your instructor for assistance as needed.

PROCEDURES AND/OR TASKS:

1. Using the hacksaw, cut the conduit to a length of 10".
2. Install the conduit into the outlet box using the proper connector.
3. Have your instructor check your work.
4. Replace the tools.
5. Clean the work area.

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Electrical Installation

NAME OF JOB: Conductors/Thin-Wall Conduit

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and properly install thin-wall conduit.

TOOLS AND EQUIPMENT: Hacksaw, reamer, pliers

MATERIALS: 1' of thin-wall conduit, electrical outlet box, pressure coupling

GENERAL INSTRUCTIONS: Using safety procedures, follow the procedures given below. Ask your instructor for assistance as needed.

PROCEDURES AND/OR TASKS:

1. Using the hacksaw, cut the conduit to a length of 10".
2. Using the reamer, remove any burrs.
3. Install the conduit into the outlet box using the pressure coupling.
4. Have your instructor check your work.
5. Replace the tools.
6. Clean the work area.

JOB SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Electrical Installation

NAME OF JOB: Conductors/Armored Cable

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and properly install armored cable.

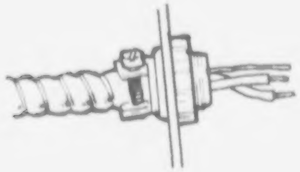
TOOLS AND EQUIPMENT: Pliers, screwdriver, knife

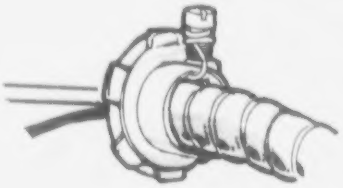
MATERIALS: 18" of armored cable, electrical outlet box, connector

GENERAL INSTRUCTIONS: Using safety procedures, follow the procedures given below. Ask your instructor for assistance as needed.

PROCEDURES AND/OR TASKS:

1. Remove armored covering from six inches of cable.
2. Using the knife remove insulation from 1 inch of each wire.
3. Connect the cable to the electrical box using the proper connector.





(**NOTE**: Be sure to ground the cable to the connector.)

4. Have your instructor check your work.
5. Replace the tools.
6. Clean the work area.

LP-X-16
LP-X-17
LP-X-18
LP-X-19

STUDENT INFORMATION SHEET

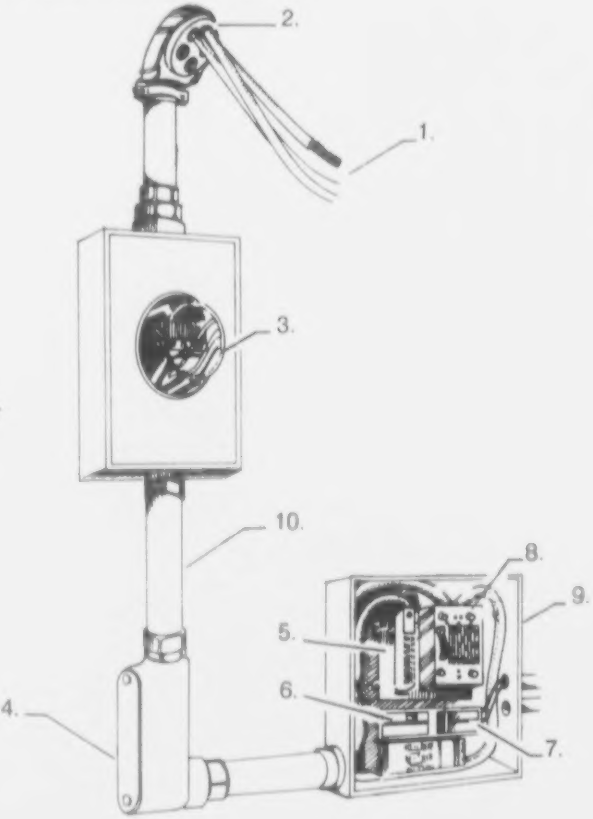
ELECTRICAL TRADES I

UNIT:	Electrical Installation
TOPIC:	Residential Service Entrance
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will demonstrate the ability to identify and install a residential service entrance.

The service entrance is made of all the wires, devices, and fittings that carry power from the power company's transformer to the consumer. Before any electrical energy reaches the consumer it must first pass through the service entrance. The components of the service meter protect and distribute the power to the branch circuits.

The parts of an electrical entrance includes the following:

1. Lead wires
   - Hot wire
   - Neutral wire
2. Entrance head
3. Meter box
4. Entrance ell
5. Neutral bar
6. Single pole breaker
7. Two pole breaker
8. Main breaker
9. Panel
10. Conduit



The location of the service must be decided on prior to installation. Most power companies will *spot* the location of the point of attachment of the service. However, at times the location of the service entrance will be left up to the electrician. It is important to keep in mind several factors when deciding on the location, such as:

1. It should be installed in as straight a path as possible.
2. The equipment should be protected from the elements.
3. It should not be in bathrooms, storerooms, closets or damp cellars.
4. The enclosure for the meter should be mounted about 65" above grade.
5. The service panel should be as close to branch circuits as possible.
6. The service conductors should be as short as possible to avoid voltage losses.
7. The disconnect for the service should be located at or very near the point of entry.
8. The service conductors should enter the structure as close to the service panel as possible.

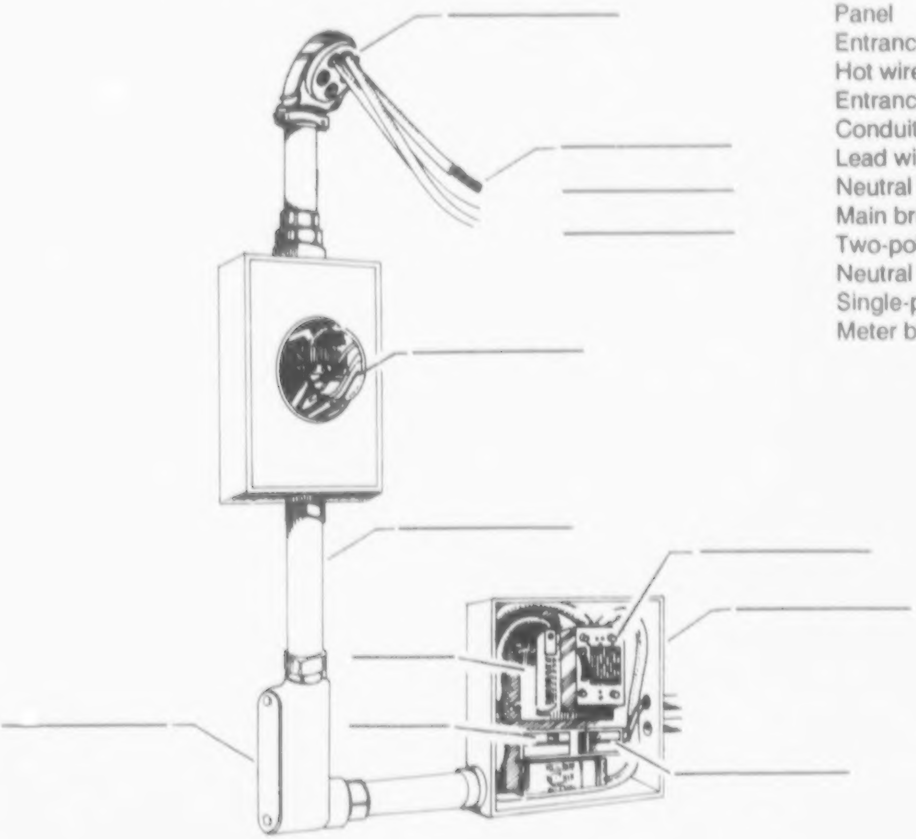
Before installing a service entrance you should check the local code or the *Code* to determine the type of conductors to use. Regardless of the type of cable or conduit used, it must be securely fastened to the building with the proper clamps or support.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:________________________________ **DATE:**________________________

UNIT:	Electrical Installation
TOPIC:	Identify Electrical Service Entrance Parts
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate the ability to identify and install an electrical service entrance.
REFERENCE:	Student Information Sheet/Electrical Service Entrance
DIRECTIONS:	Using the picture below and the Student Information Sheet/Residential Service Entrance, identify ten major parts of an electrical service entrance by writing the answer in the space provided.



- Panel
- Entrance head
- Hot wire
- Entrance ell
- Conduit
- Lead wires
- Neutral bar
- Main breaker
- Two-pole breaker
- Neutral wire
- Single-pole breaker
- Meter box

JOB SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Electrical Installation

NAME OF JOB: Residential Service Entrance

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and install a residential service entrance.

TOOLS AND EQUIPMENT: Hacksaw, screwdriver, pliers, hammer, shovel, multipurpose tool

MATERIALS: Conductor (RHH, THW, THWW, XHHX, RUX, XLP, or RHW), entrance head, meter box, entrance ell

GENERAL INSTRUCTIONS: Using proper safety precautions, assist the other members of your class in installing an electrical service entrance. Refer to Student Information Sheet/Residential Service Entrance. Using your textbooks and student information sheet as references you will install an electrical service entrance on the practice wall in your classroom.

PROCEDURES AND/OR TASKS:

1. Working closely with your instructor, outline the steps necessary in installing an electrical service entrance.
2. Develop a chart showing the steps necessary.
3. Check off each step as it is completed.
4. Have your instructor check your work as each step is completed.
5. Replace the tools.
6. Clean the work area.

JOB SHEET

ELECTRICAL TRADES I

NAME:________________________ **DATE:**________________

UNIT: Electrical Installation

NAME OF JOB: Power Panels

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and install a power panel.

TOOLS AND EQUIPMENT: Screwdriver, cable cutter or hacksaw, knife, allen wrench 1/4 inch, cable ripper

MATERIALS: Wiring demonstration panel (provided by instructor), meter base and plank, 7 feet of No. 2/0 three-wire cable, two 1 1/2 inch cable connectors, one 2/0 cable strap, antioxidant compound

GENERAL INSTRUCTIONS: Using proper safety precautions, follow the instructions given.

PROCEDURES AND/OR TASKS:

1. Strip 7 inches of sheathing and insulation from both ends of the No. 2/0 cable.
2. Remove proper size knockout from top of SEP.
3. Slide a cable connector over one end of the cable.
4. Insert the cable into top of the SEP and fasten the cable connector.
5. Apply antioxident to aluminum wires.
6. Inside the service panel, insert the black wire into one of the terminals at the top of the breaker pole. Insert the other insulated wire in the other terminal. Fasten these wires by tightening with an allen wrench or screwdriver.
7. Insert the other end of the cable into a cable connector and then into the bottom of the service meter box. Secure the wires as in the previous step.
8. Fasten the cable connector to the meter box.
9. Secure the cable with a No. 2/0 cable strap.
10. Have your instructor check your work.

11. Replace the tools.
12. Clean the work area.

JOB SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Electrical Installation

NAME OF JOB: Power Feeder

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and install a power feeder.

TOOLS AND EQUIPMENT: Knife, wire stripper, screwdriver, rule

MATERIALS: No. 10 three-wire cable with ground, double-pole circuit breaker (30-amp), pencil

GENERAL INSTRUCTIONS: A feeder is a circuit between the SEP and the fuse of a circuit breaker which protects a branch circuit. Following instructions given install a power feeder from the SEP to the breaker box.

PROCEDURES AND/OR TASKS:

1. Remove a knockout from the upper right corner of the SEP.
2. Run out of the SEP for a length of three feet.
3. Strap the cable to the practice wall.
4. Tighten the cable connectors and cut cable which extends into SEP to a length of 18 inches.
5. Remove sheathing from this part of the cable.
6. Strip insulation from the end of each insulated wire (Strip length is indicated on the side of circuit breaker.)
7. Connect the white and bare copper wires to the neutral bar in the SEP.
8. Snap the 30-amp double-pole circuit breaker to the bus bar.
9. Using the screwdriver, connect the red and black wires to the circuit breaker.
10. Have your instructor check your work.
11. Replace the tools
12. Clean the work area.

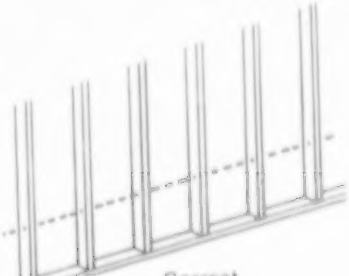
STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

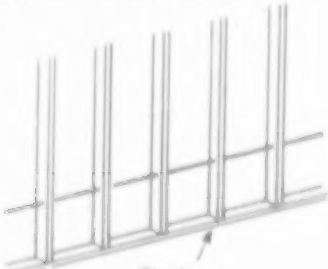
UNIT:	Electrical Installation
TOPIC:	Pulling Cable
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will demonstrate an understanding of how electrical cable is pulled.

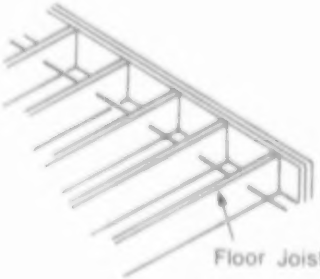
I. Installing Cable Runs

A. Holes should be drilled as straight as possible in studs to aid in pulling wires. The holes should also be drilled in the center of the studs to provide protection for the cable. The same applies to floor joists as well.

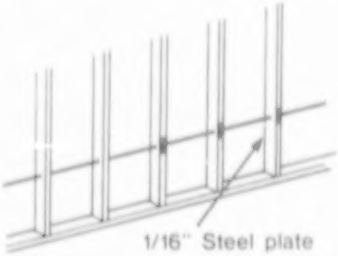


Correct

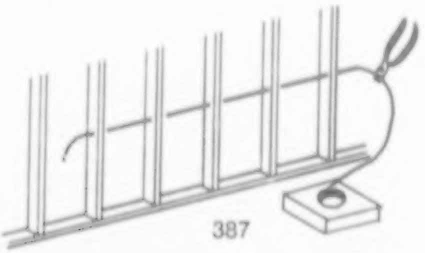




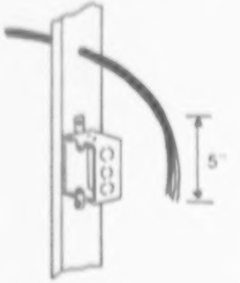
B. In some cases, studs or floor joists may have to be notched instead of drilled. When studs or floor joists are notched, a steel plate at least 1/16-inch thick must be used to cover the notch.



C. Cable should be pulled to where it should be and then cut to the right length. This helps avoid waste.

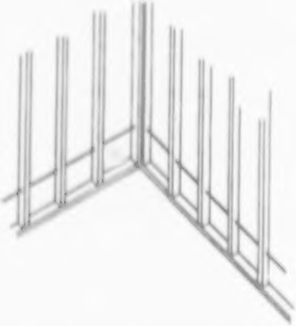


D. Cable insulation should be removed before being installed into box.

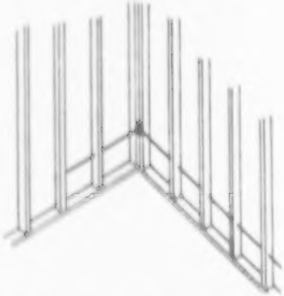


II. Methods of Routing Cable Around Corners

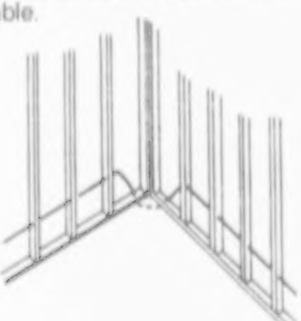
A. Drill holes from each side at an angle. This method will save wire, but takes much time if holes do not match.

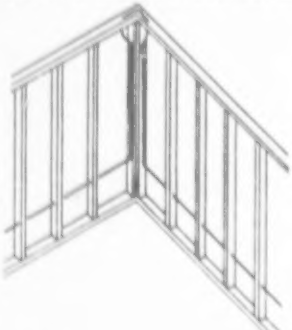


B. Notch the corner studs; however, notching requires a steel plate for protection.



C. Routing over or under the corner. The under-corner method takes the most time and usually takes two people. The over-corner method is the quickest, but uses more cable.





ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:________________________________ **DATE:**________________________

UNIT:	Electrical Installation
TOPIC:	Pulling Cable
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate an understanding of how electrical cable is pulled.
REFERENCE:	Student Information Sheet/Pulling Cable
DIRECTIONS:	Read and answer as required.

1. How should holes be drilled in studs and floor joists prior to running cable?

2. When studs of floor joists are notched, what must be done?

3. List four ways of routing cable around corners.

   a.

   b.

   c.

   d.

4. Why should cable be pulled to its proper place and then cut for length?

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Electrical Installation

TOPIC: Box Identification and Installation

UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate an understanding of box identification and installation.

I. Electrical Boxes

- A. Metal
- B. Plastic
- C. Fiber
- D. Nylon
- E. Rubber

II. Types of Boxes

- A. Handy (used for splices, switches, outlets, pull boxes)
- B. Outlet (used for switches and receptacles)
- C. Octagon (used mainly for lighting)
- D. Square (used with covers designed for special purposes, such as switch-receptacle combination)

III. General Information

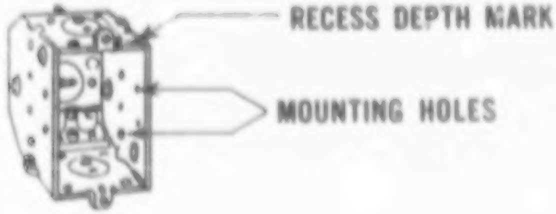
- A. Must be installed at every point where cable will be spliced or cut off.
- B. Usually secured by nails driven through back of box or through straps.
- C. Straps may be mounted on the side or front of box, depending on where box is located.
- D. Bar hangers are often used in ceilings.
- E. Boxes can be bought with threaded holes for grounding screws, or with screws with pigtails or with grounding clips.

IV. Installation of Box

A. Find where outlet box should go.

B. Find box mounting holes and recess depth mark on box.

(NOTE: Recess depth mark is a slight indention about 1/4 inch from box opening.)

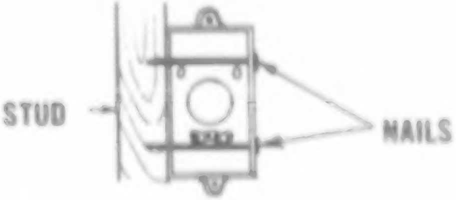


C. Decide which nail holes to use.

D. Hold box in desired position, with recess depth mark even with edge of stud.

E. Drive nails through holes into stud until nails are snug against box.

F. Check box to be sure it is held tightly in place.



ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT:	Electrical Installation
TOPIC:	Box Identification and Installation
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate an understanding of box identification and installation.
REFERENCE:	Student Information Sheet/Box Identification and Installation
DIRECTIONS:	Follow instruction given below.

1. List four things electrical boxes are made of.

   a.

   b.

   c.

   d.

2. List the four types of boxes and their uses.

   a.

   b.

   c.

   d.

3. Answer the following statements true or false by placing a T for True and an F for False in the space at the left.

_____ a. Boxes are usually secured by nails.

_____ b. Bar hangers may be used in ceilings.

_____ c. Straps may not be mounted on the side of the box.

_____ d. Boxes must not be installed at cable splices.

_____ e. Boxes may be bought with threaded holes for grounding screws.

_____ f. Straps may be mounted on the front of box.

_____ g. Nails may be driven through back of box.

_____ h. Boxes must be installed where cables are cut off.

_____ i. Boxes may be bought with screws with pigtails for grounding.

_____ j. Boxes may be purchases with grounding clips.

4. List the six steps for installing a box.

a.

b.

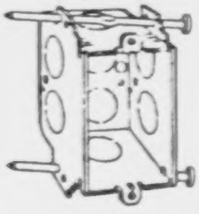
c.

d.

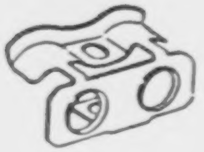
e.

f.

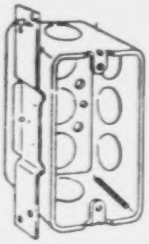
5. Identify the following boxes.



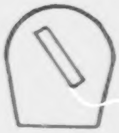
a. ____________________



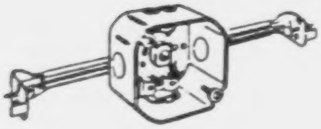
b. ____________________



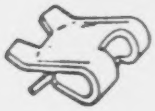
c. ____________________



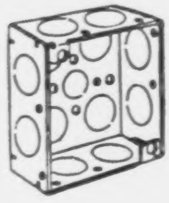
d. ____________________



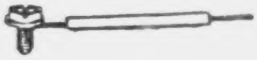
e. ____________________



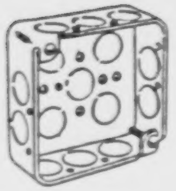
f. ____________________

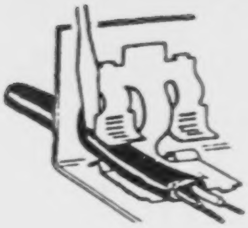


g. ____________________



h. ____________________





i. ____________________

j. ____________________

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JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**____________________

UNIT: Electrical Installation

NAME OF JOB: Mounting Electrical Boxes

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to mount electrical boxes.

TOOLS AND EQUIPMENT: Claw hammer

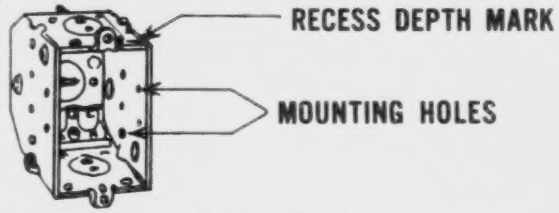
MATERIALS: Outlet box, junction box, 16d box nails

GENERAL INSTRUCTIONS: Using proper safety precautions, follow the procedures below.

PROCEDURES AND/OR TASKS:

1. Locate desired position of outlet box.
2. Locate box mounting holes and recess depth mark on box.

   (NOTE: Recess depth mark is a slight indention approximately 1/4 inch from box opening.)



3. Determine which nail holes should be used.
4. Hold box in desired position with recess depth mark even with edge of stud.
5. Drive nails through holes into stud until nails are snug against the box.
6. Check box to be sure it is held tightly in place.
7. Repeat steps A through F for mounting junction box.

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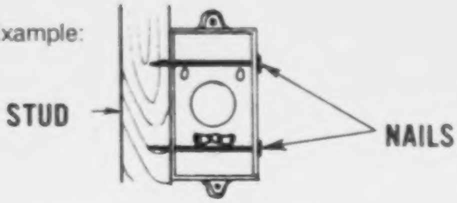
Example:



8. Have instructor check your work.

9. Clean work area.

10. Store tools properly.

STUDENT INFORMATION SHEET

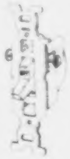
ELECTRICAL TRADES I

UNIT:	Electrical Installation
TOPIC:	Electrical Switch Boxes
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will demonstrate the ability to identify and properly install electrical switch boxes.

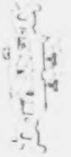
Switches--For any electrical circuit, there must be a control device. Switches are used to open and close circuits as faucets are used to control the flow of water in plumbing. Switches can be simple, complex, hand controlled, or automatically controlled. Current and voltage ratings are always listed on the switch. Pay close attention to these listings because not doing so could damage the switch or cause electrical shorts and shock.

A. Types

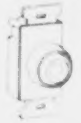
1. Single pole switch--most common



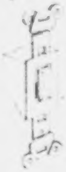
2. Three-way switch--used to control a light from two locations



3. Dimmer switch--a type of single pole switch used to control the amount of voltage going to fixture



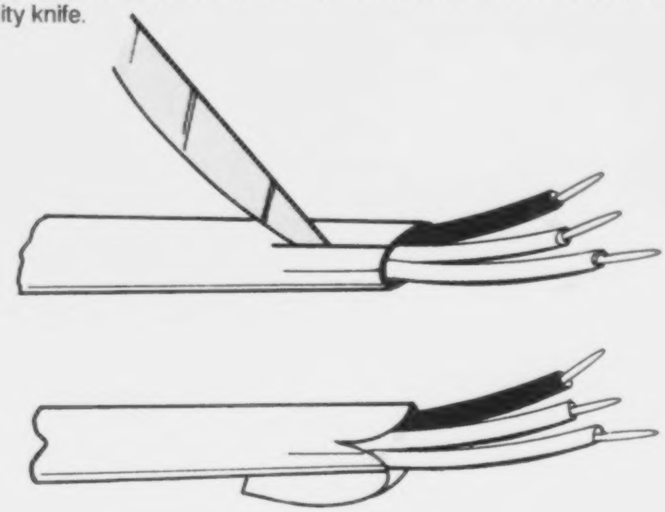
4. Push-button switch--identical to the single pole switch except it has a push-button instead of a lever



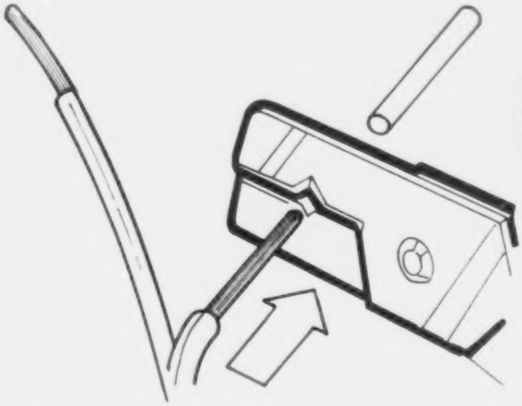
ELECTRICAL INSTALLATION

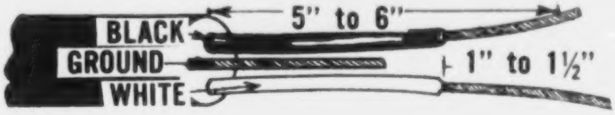
B. Switch installation--single pole

1. The outside cable insulation can be removed about six inches with wire stripper or utility knife.

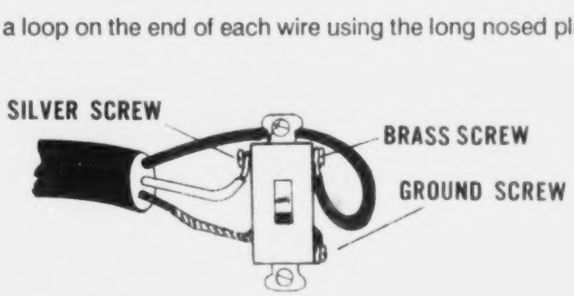


2. Strip at least 1 to 1 1/2 inches of insulation from the two conductors using the wire stripper.



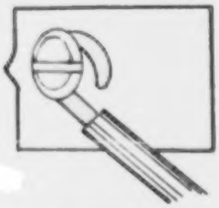

BLACK
GROUND
WHITE
5" to 6"
1" to 1½"

3. Make a loop on the end of each wire using the long nosed pliers.

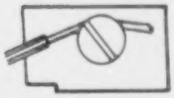

SILVER SCREW
BRASS SCREW
GROUND SCREW

4. Using the screwdriver, attach the wire loops to the screws on the switch as shown.

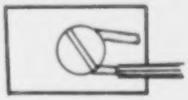
CORRECT

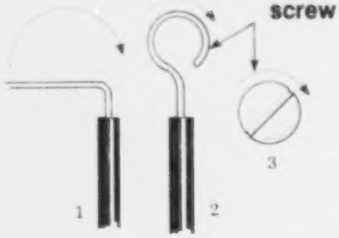


WRONG
(End not looped)



WRONG
(End too long)



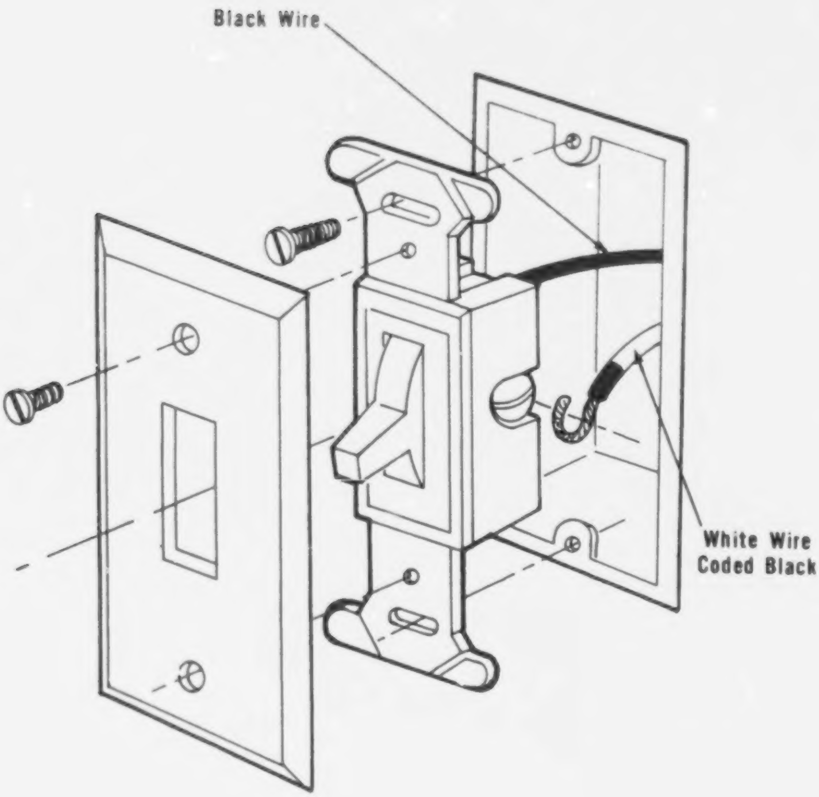


bend wire, loose end to right, tighten screw clockwise

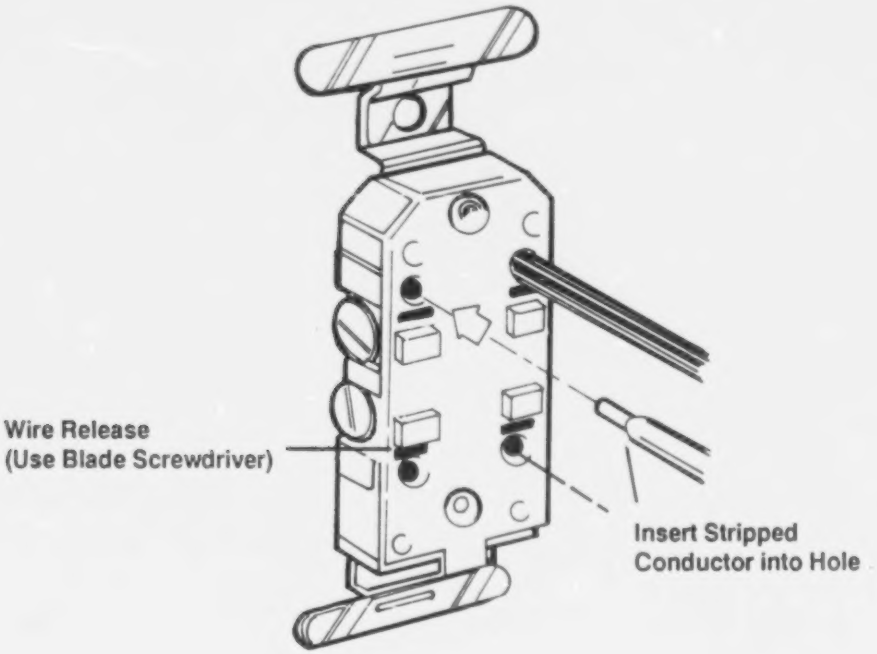
(NOTE: Make sure the wire loop is on the screw in the clockwise position.)

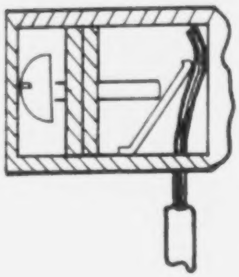
(NOTE: Silver-colored screws on the switch indicate neutral terminal. Bronze-colored screws indicate the hot terminal. Green-colored screws indicate ground.)

5. After making sure all screws are snug and all uninsulated wire is under the screws, fasten the switch to the box with the mounting screws; then attach the cover.


Black Wire
White Wire
Coded Black

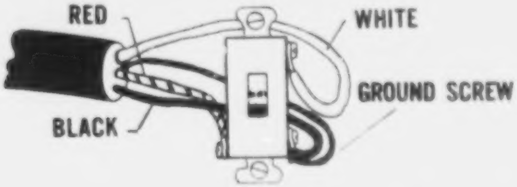
6. For the more modern switches that do not have terminal screws and contain back-wired "quick connectors," just simply strip the ends of the wire about 3/4-inch and insert.


Wire Release
(Use Blade Screwdriver)
Insert Stripped
Conductor into Hole

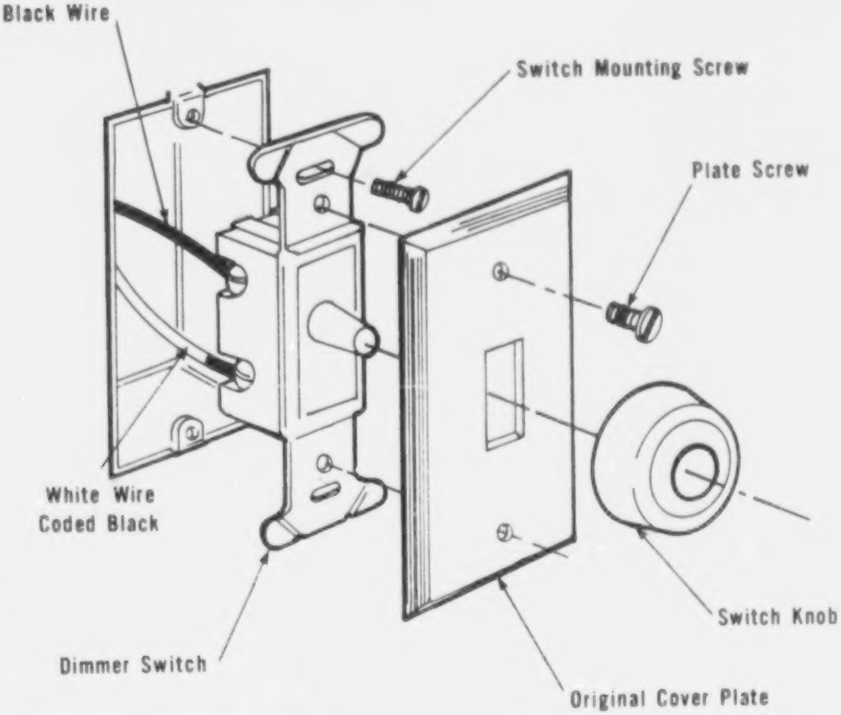


Black-wired quick connectors. The wire is held in place by spring tension or screw tension

C. Switch installation (three way)--Follow the same steps as single pole but wire as shown.


RED
WHITE
GROUND SCREW
BLACK

D. Switch installation (dimmer)--Follow the same steps as single pole.


Black Wire
Switch Mounting Screw
Plate Screw
White Wire
Coded Black
Switch Knob
Dimmer Switch
Original Cover Plate

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________ **DATE:** ______________________

UNIT:	Electrical Installation
TOPIC:	Installation of Switches
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate a knowledge of switch installation.
REFERENCE:	Student Information Sheet/Electrical Switch Boxes
DIRECTIONS:	Follow the instructions given.

1. What do silver-colored screws, bronze-colored screws, and green-colored screws on the receptacles and switches represent?

   a. silver-colored--

   b. bronze-colored--

   c. green-colored--

2. List the four types of switches.

   a.

   b.

   c.

   d.

LP-X-24

JOB SHEET

ELECTRICIALN TRADES I

NAME:____________________________________ **DATE:**____________________

UNIT: Electrical Installation

NAME OF JOB: Electrical Switch Boxes

UNIT OBJECTIVE: After completion of this unit, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and install a single pole switch.

TOOLS AND EQUIPMENT: Practice board with empty device box and empty octagon box, single pole switch, light socket, 120v supply line, 120v incandescent bulb, long nose pliers, pocket knife, wire strippers, safety glasses

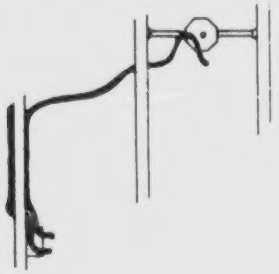
MATERIALS: 12-2-G or 14-2-G NM cable, wire connectors

GENERAL INSTRUCTIONS: Start by checking to see that you have all the tools, equipment, and materials required. Before you begin working, put on the safety glasses.

PROCEDURES AND/OR TASKS: Using the following steps, wire the light socket and single pole switch.

STEPS:

1. Remove the KO's from boxes if they are still in place.
2. Run cable between device box and octagon box as shown below.

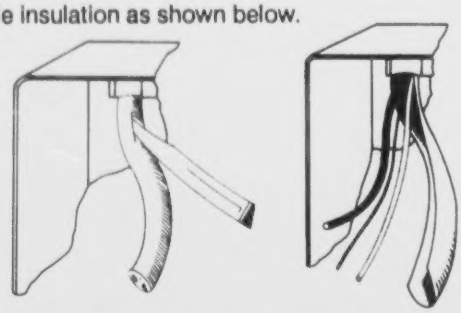


(NOTE: Leave at least 8" extending past the surface of your device and lighting boxes.)

3. Staple cable within 12" of all metal boxes, 8" of all nonmetallic boxes.

   (NOTE: Cables should be run flat when possible.)

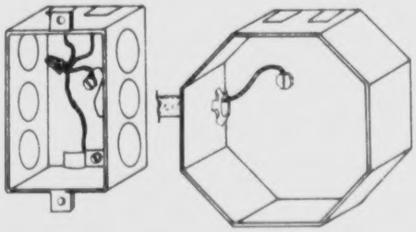
4. Strip cable insulation as shown below.



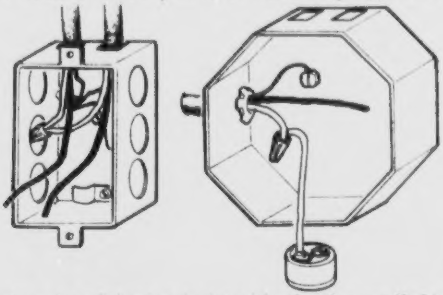
   (NOTE: Cables could be stripped before they are installed in the boxes. Cable covering may be trimmed to within 1/4" of its point of entry.)

   (**CAUTION**: Use extreme care when using a knife.)

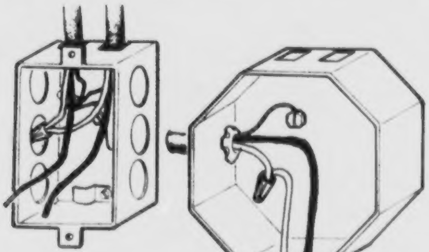
5. Connect all ground wires (green or bare) shown below.



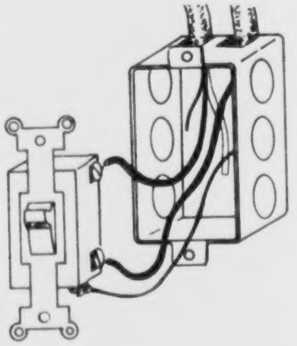
6. Connect all neutral wires (white or natural gray) as shown.



7. Connect return leg (black wire) to black wire on light socket.

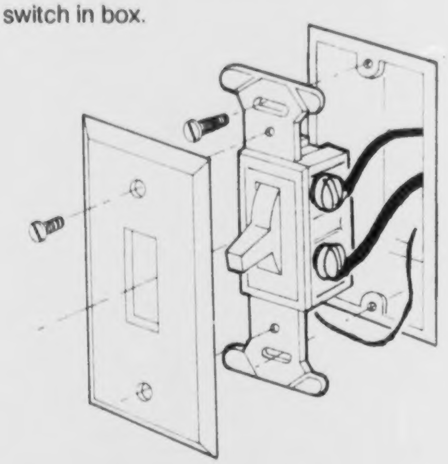


8. Connect switch as shown below.



(NOTE: Be sure that the loop in the black conductor wires is turned in the direction that the terminal tightens (clockwise).

9. Install switch in box.



10. Connect light socket to octagon box.

11. Have instructor check your work.

12. Clean work area.

13. Store tools properly.

688

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**____________________

UNIT: Electrical Installation

NAME OF JOB: Installing a 3-Way Switch

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to install a 3-way switch.

TOOLS AND EQUIPMENT: Utility knife, wire stripper, conventional screwdriver, chain nose or long nose pliers

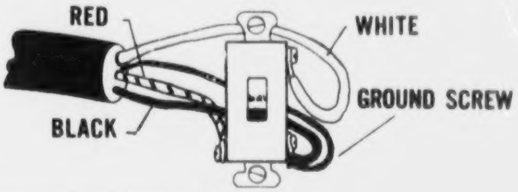
MATERIALS: 3-way switch, 3 wire NM cable

GENERAL INSTRUCTIONS: Using safety procedures, follow the procedures given.

PROCEDURES AND/OR TASKS:

1. Strip six inches of outer insulation off cable with utility knife.
2. Strip 1 1/2 inches off end of each wire.
3. Make loop on end of each wire.
4. Connect wires to switch as shown below (in clockwise direction).

   Example:



5. Have instructor check work.
6. Clean work area.
7. Store tools properly.

ELECTRICAL INSTALLATION

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Electrical Installation

TOPIC: Electrical Outlet Boxes

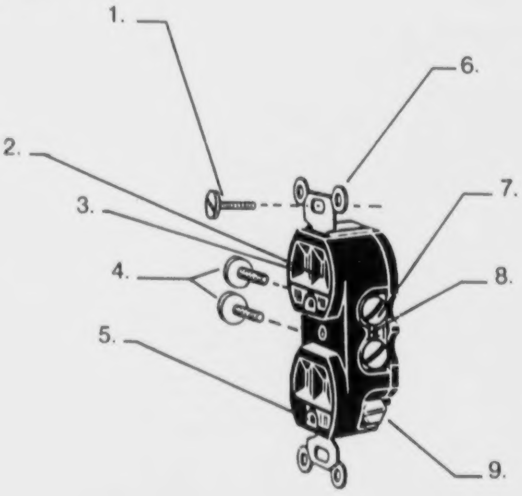
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to identify and install electrical outlet boxes.

Before beginning to install an electrical receptacle, it is important to know the parts. Study the drawing below until you are able to identify the parts correctly.

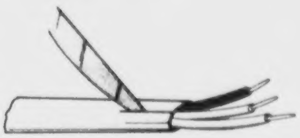
RECEPTACLE

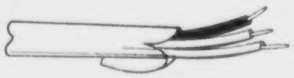
1. Mounting screws
2. Ungrounded contact slot (narrow)
3. Grounded contact slot (wide)
4. Grounded terminals (white)
5. Grounding contact clot (semi-oval)
6. Strap or yoke
7. Ungrounded terminal (copper)
8. Break off fin
9. Grounding terminal



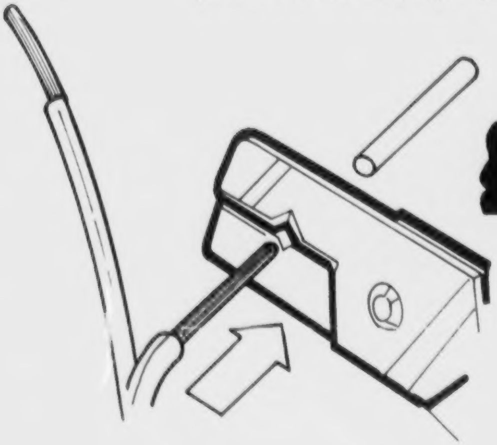
There are steps to follow when installing receptacles. Become familiar with the steps given below for receptacle installation.

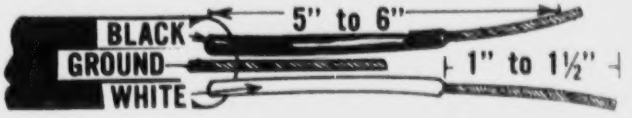
1. Remove about six inches of insulation with wire stripper or utility knife.



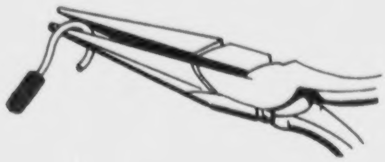


2. Strip at least 1/2 to 1 inch of insulation from the two conductors using the wire stripper. (Be sure to use the proper gauge hole on the stripper.)

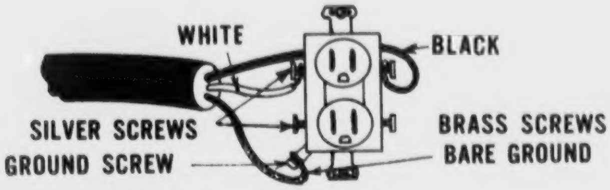



BLACK
GROUND
WHITE
5" to 6"
1" to 1½"

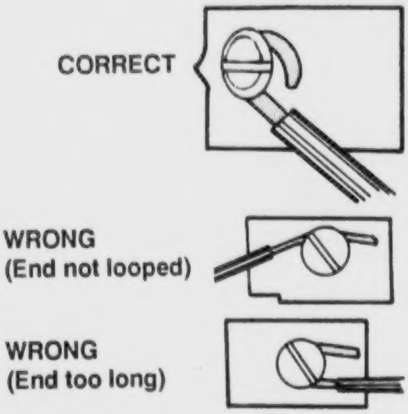
3. Make a loop on the end of each wire using the long nose pliers.



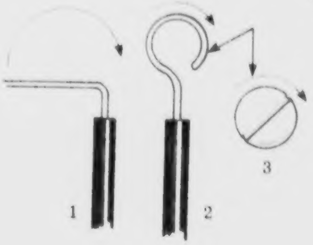
4. Using the screwdriver, attach the wire loop to the screws on the receptacle as shown.


WHITE
BLACK
SILVER SCREWS
BRASS SCREWS
GROUND SCREW
BARE GROUND

(NOTE: Make sure the wire loop is on the screw in the clockwise position.)


CORRECT
WRONG
(End not looped)
WRONG
(End too long)

Bend and tighten in clockwise Direction



(NOTE: Silver-colored screws on the receptacle indicate neutral terminal, bronze-colored screws indicate the hot terminal, and green screws indicate the ground.)

5. Make sure all screws are snug, and all uninsulated wire is under the screws. Next, fasten the receptacle to the box with the mounting screws; then attach the cover.

6. For the more modern receptacles that do not have terminal screws and contain back wired "quick connectors," just strip the ends of the wire about 3/4-inch and insert.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:____________________ **DATE:**________________

UNIT: Electrical Installation

TOPIC: Installation of Receptacles

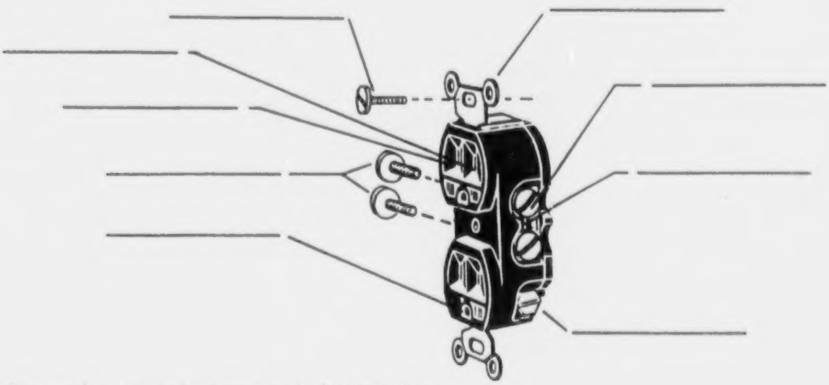
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate a knowledge of receptacle installation.

REFERENCE: Student Information Sheet/Electrical Outlet Boxes

DIRECTIONS: Follow the instructions given.

1. Label the parts of the receptacle.



2. List the five major steps in receptacle installation.

   a.

   b.

   c.

   d.

   e.

JOB SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Electrical Installation

NAME OF JOB: Electrical Outlet Boxes

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and install electrical outlet boxes.

TOOLS AND EQUIPMENT: Wire stripper, utility knife, conventional screwdriver, long nose pliers

MATERIALS: Duplex receptacles

GENERAL INSTRUCTIONS: Using safety precautions, follow the procedures below.

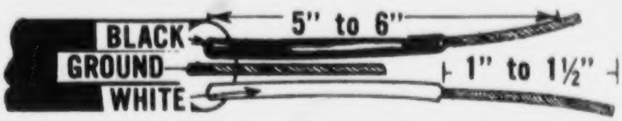
PROCEDURES AND/OR TASKS:

1. Remove about six inches of outside insulation from the end of the cable with the utility knife.

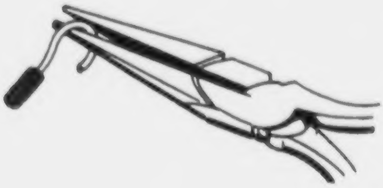
   (CAUTION: Do not cut the insulation on the wires under the outside insulation.)

2. Remove 1 to 1 1/2 inches of insulation from the two conductors using the wire stripper.

   (NOTE: Be sure to use the proper gauge hole on the stripper.)



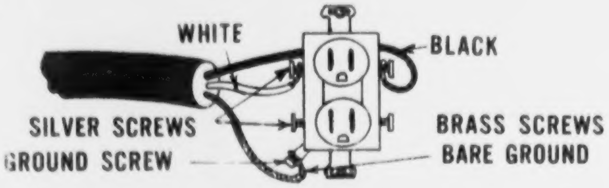
3. Make a loop on the end of each wire using the long nose pliers.



4. Using the screwdriver, attach the wires to the receptacle as shown below

(NOTE: Be sure the wire loop is on the screw in the clockwise position.)

Example:


WHITE
BLACK
SILVER SCREWS
BRASS SCREWS
GROUND SCREW
BARE GROUND

5. Mount receptacle in outlet box.

6. Tighten mounting screws.

7. Have instructor check your work.

8. Clean work area.

9. Store tools properly.

LP-X-28
LP-X-29

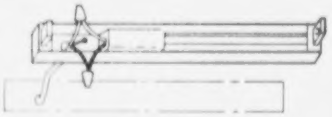
STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

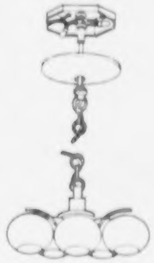
UNIT:	Electrical Installation
TOPIC:	Internal Installation
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will demonstrate the ability to identify and install internal light fixtures and receptacles.

I. Types of Fixtures

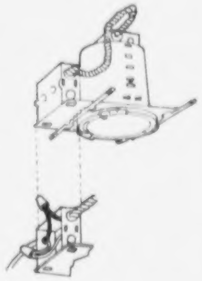
A. Fluorescent



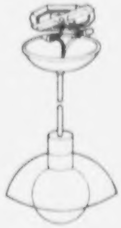
B. Chandeliers--multiple sockets



C. Recessed

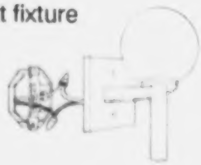


D. Ceiling fixtures--supported (some with threaded ears and some without)



686

E. Outdoor light fixture



II. Parts of Fluorescent Lamp Fixture

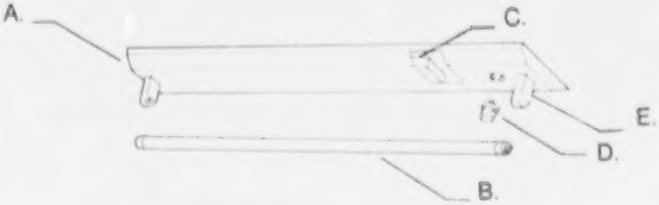
A. Fixture

B. Bulb

C. Ballast

D. Starter

E. Holder



III. Parts of a Multiple Socket, Pipe-Supported Light Fixture

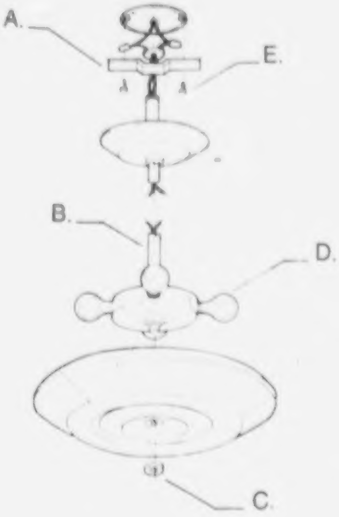
A. Fixture strap

B. Threaded pipe

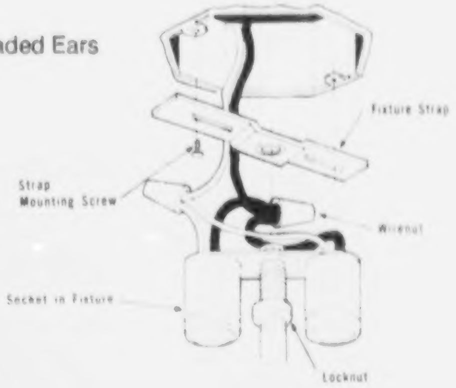
C. Locknut

D. Multiple socket

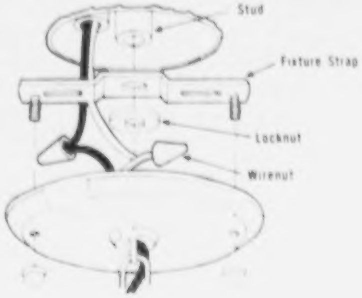
E. Strap mounting screws



IV. Parts of a Pipe-Supported Fixture with Threaded Ears


Fixture Strap
Strap Mounting Screw
Wirenut
Socket in Fixture
Locknut

V. Parts of a Lamp Fixture Without Threaded Ears


Stud
Fixture Strap
Locknut
Wirenut

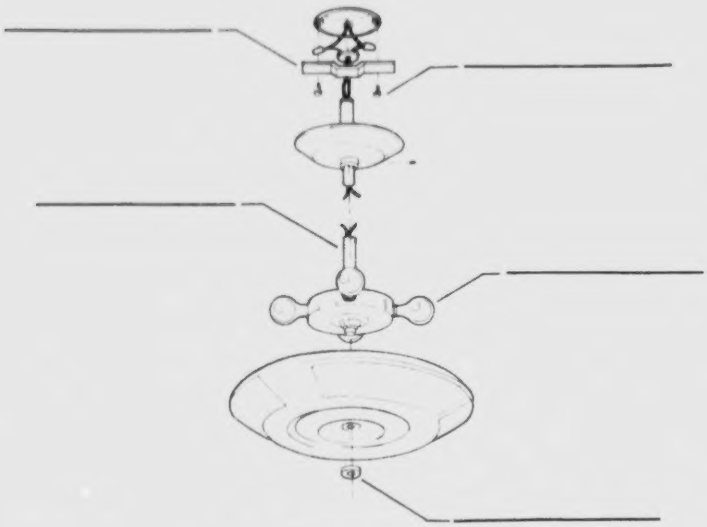
ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________ **DATE:** ____________________

UNIT:	Electrical Installation
TOPIC:	Identifying Parts of a Pipe-Supported Lamp Fixture
UNIT OBJECTIVE:	After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate a knowledge of the parts of a pipe-supported lamp fixture.
REFERENCE:	Student Information Sheet/Internal Installation
DIRECTIONS:	Using the list of terms, choose the correct name of each part of a pipe-supported lamp fixture and write it in the correct blank.

Multiple Socket
Fixture Strap
Strap Mounting Screw
Threaded Pipe
Locknut



ELECTRICAL INSTALLATION

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Electrical Installation

TOPIC: Identifying Parts of a Fluorescent Lamp Fixture

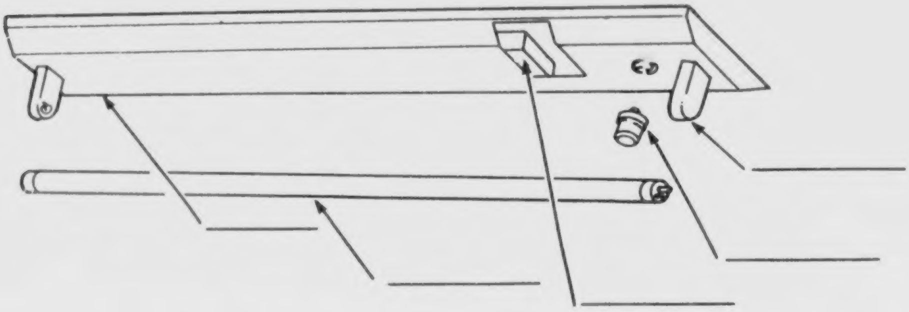
UNIT OBJECTIVE: After completing this unit of instruction, the student will be able to demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate a knowledge of the parts of a fluorescent lamp fixture.

REFERENCE: Student Information Sheet/Internal Installation

DIRECTIONS: Using the list of terms, choose the correct name of each part of a fluorescent lamp fixture and write it in the correct blank.

Starter
Holder
Fixture
Bulb
Ballast



LP-X-29

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Electrical Installation

NAME OF JOB: Internal Installation

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and install an internal light fixture.

TOOLS AND EQUIPMENT: Wire stripper, screwdriver, pliers

MATERIALS: Wire nuts

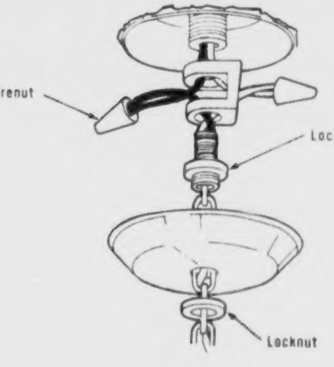
GENERAL INSTRUCTIONS: Using safety precautions, follow the procedures below.

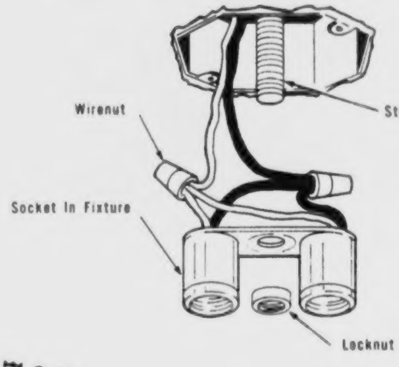
PROCEDURES AND/OR TASKS:

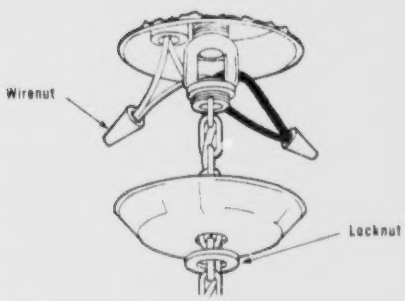
1. Make sure you have about 1 inch to 1 1/2 inches of bare copper (cable) conductor or the end of each line before you start connections.
2. Use wirenuts to splice wires together.
3. Hold the fixture to support its weight until you attach mounting screws.

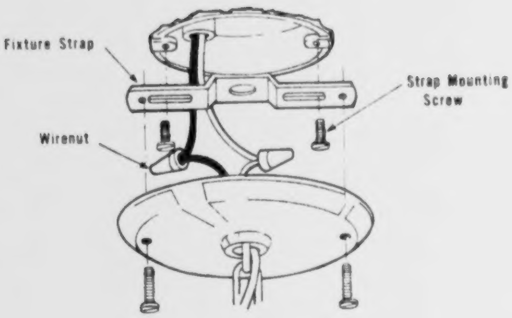
   (NOTE: The fixture should not be allowed to swing freely on just the wirenut connection because the fixture's weight could cause it to pull loose and fall.)
4. Attach mounting screws.

   (NOTE: Don't over tighten as this may cause the fixture not to hang straight.)
5. Attach the globes and other decorations.






Wirenut
Locknut


Fixture Strap
Strap Mounting Screw
Wirenut

6. Replace the tools.
7. Clean the work area.

LP-X-30
LP-X-31

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

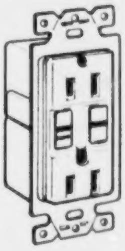
UNIT: Electrical Installation

TOPIC: External Installation

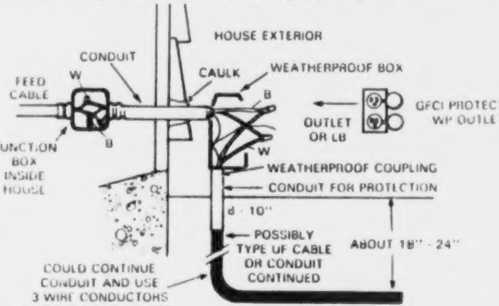
UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate the ability to identify and install external light fixtures and receptacles.

External wiring procedures differ from internal procedures. Regular switches, receptacles and lamps are not suitable for outdoor use since they may be easily damaged by the elements. The *National Electrical Code* requires that special weatherproof housing units or devices be used. You may use standard receptacles and switches if they are mounted inside of special weatherproof housings. The *Code* also requires that outside receptacle circuits be ground-fault circuit interrupter (GFIC) protected. A GFIC protected receptacle works by opening the circuit if a current leakage or fault (to ground) exceeds 0.006 A, (6 mA). The GFIC will sense any imbalance greater than 6 mA and will immediately open the circuit, stopping the dangerous current flow.



There are special considerations you should keep in mind when doing outside installation. Properly protected switches and receptacles must be used. It is also important to note that a different type of cable is preferred, this being UF cable. UF cable is essentially weatherproof. Other weatherproof conductors such as type XLP may be buried directly or channeled through conduit. For added safety UF cable should be encased in rigid metal or plastic conduit, especially where it enters the ground.


HOUSE EXTERIOR
CONDUIT
W
FEED CABLE
CAULK
WEATHERPROOF BOX
B
OUTLET OR LB
GFCI PROTECTED WP OUTLET
JUNCTION BOX INSIDE HOUSE
B
W
WEATHERPROOF COUPLING
CONDUIT FOR PROTECTION
d - 10"
POSSIBLY TYPE UF CABLE OR CONDUIT CONTINUED
ABOUT 18" - 24"
COULD CONTINUE CONDUIT AND USE 3 WIRE CONDUCTORS LIKE XLP OR XHHN, ETC

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Electrical Installation

TOPIC: External Installation

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate the ability to identify and install external light fixtures and receptacles.

REFERENCE: Student Information Sheet/External Installation

DIRECTIONS: Read each of the following statements. Indicate if the statement is true or false by circling the T or F.

T F 1. Wiring procedures used in external wiring are the same as used in internal wiring.

T F 2. Regular switches, receptacles and lamps are not suitable for outdoor use.

T F 3. You may use standard receptacles and switches if they are mounted inside of special weatherproof housings.

T F 4. A GFIC protected receptacle works by closing the circuit if a current leakage of fault exceeds 0.006 A.

T F 5. The GFIC senses any imbalance greater than 6 mA and will immediately open the circuit.

T F 6. UF cable is preferred for outdoor wiring.

T F 7. You may use the same type of conductor for external wiring as used for internal wiring.

T F 8. UF cable is essentially weatherproof.

T F 9. Other weatherproof conductors such as type XLP may be used.

T F 10. For added safety UF cable should be encased in rigid metal or plastic conduit.

LP-X-31

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Electrical Installation

NAME OF JOB: External Installation

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to identify and install various electrical components.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to identify and install an external receptacle.

TOOLS AND EQUIPMENT: Hacksaw, reamer, screwdriver, drill, drill bit, multipurpose tool or knife

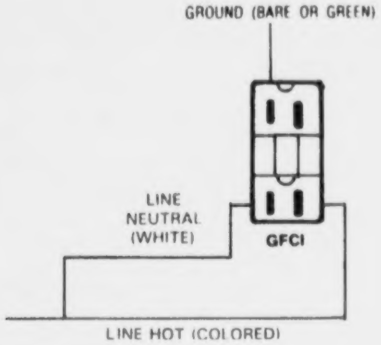
MATERIALS: 1' of metal conduit, connector, weatherproof housing for receptacle, GFIC, UF of XLP cable, practice wall

GENERAL INSTRUCTIONS: Using proper safety precautions, follow instructions provided. Ask you instructor for assistance as needed.

PROCEDURES AND/OR TASKS:

1. Using the proper sized bit, drill a hole through the practice wall large enough to allow the conduit to fit through.
2. Using the hacksaw cut the conduit to 10".
3. Remove any burrs from the conduit with the reamer.
4. Attach the conduit to the weatherproof housing using the connector.
5. Insert the conduit through the practice wall and mount the weatherproof housing.
6. Feed the UF or XLP conductor through the conduit into the housing. Allow it to extend 6".
7. Using the multipuropse tool or knife remove 5" of cable covering and then remove one inch of insulation from the end of each wire.

8. Attach the conductor to the GFIC as shown below.


GROUND (BARE OR GREEN)
LINE NEUTRAL (WHITE)
GFCI
LINE HOT (COLORED)

9. Mount the GFIC in the housing.

10. Have your instructor check your work.

11. Replace the tools.

12. Clean the work area.

UNIT XI

TROUBLESHOOTING

TROUBLESHOOTING

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Troubleshooting

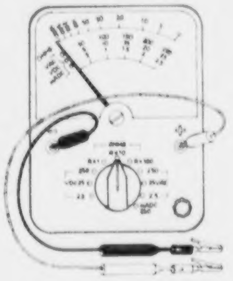
TOPIC: Troubleshooting Tools

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to troubleshoot residential electrical problems.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to identify tools used in electrical troubleshooting.

I. Voltmeter (VOM)

A. The voltmeter is an electrical instrument used to measure the difference in potential or voltage across two points along a circuit.



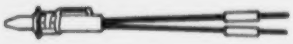
B. The voltmeter has a multiplier placed in series with the coil. A multiplier is a high value resistor.

C. Voltmeters are delicate instruments which must be handled with care.

D. Failure to place the meter in the circuit will result in damage to the instrument.

II. Neon Tester

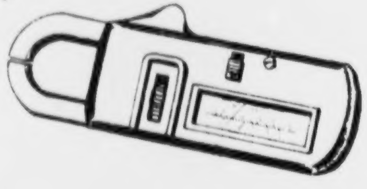
A. Used to indicate 120V or 240V by the brightness of its glow when connected across the hot and neutral wires or two hot wires of a circuit.



B. The higher the voltage, the brighter the tester will glow.

(NOTE: The VOM indicates the same information as the neon tester. However, it will be given in numerical form on a calibrated scale.)

III. Amp Clamp



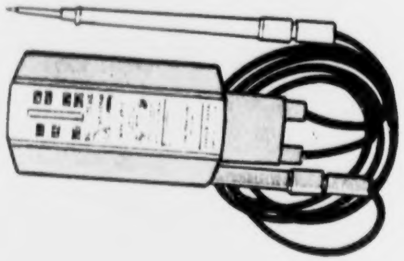
A. Used to read the current of a live conductor.

B. Gives the exact current flow.

IV. Voltage Tester

A. Lightweight, compact, and inexpensive

B. Indicates polarity and voltage



ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ____________________ **DATE:** ____________________

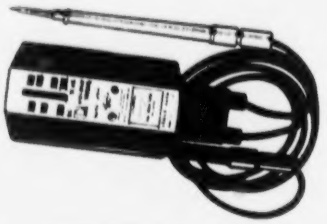
UNIT:	Troubleshooting
TOPIC:	Troubleshooting Tools
UNIT OBJECTIVE:	After completing this unit of instruction, the student will demonstrate the ability to troubleshoot residential electrical problems.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will be able to identify tools used in electrical troubleshooting.
REFERENCE:	Student Information Sheet/Troubleshooting Tools
DIRECTIONS:	Identify each of the troubleshooting tools shown below by placing the current letter in the blank.

A. neon tester

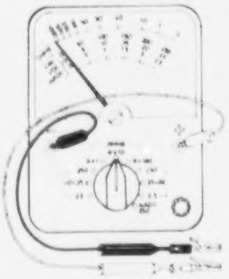
B. voltage tester

C. voltmeter

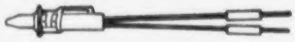
D. amp clamp



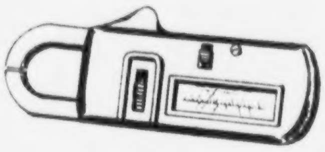
1. ____________



2. ____________



3. ____________



4. ____________

JOB SHEET

ELECTRICIAL TRADES I

NAME: ______________________________ **DATE:** ____________________

UNIT: Troubleshooting

NAME OF JOB: Electrical Receptacle Troubleshooting

UNIT OBJECTIVE: After completion of this unit of instruction, the student will demonstrate the ability to troubleshoot residential electrical problems.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to troubleshoot an electrical receptacle.

TOOLS AND EQUIPMENT: Neon tester, practice box designed by instructor for this exercise

MATERIALS: No materials needed

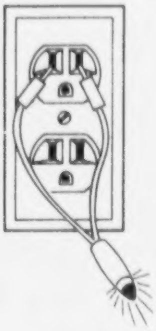
GENERAL INSTRUCTIONS: The residential electrician is often required to correct or repair faulty or malfunctioning electrical systems. There are no set steps which can be followed that will work in every situation; however, there are procedures which will be helpful.

(CAUTION: You must always be aware of safety procedures. Most of the time you will make sure the circuit has been turned off before starting work; however, when troubleshooting it is sometimes necessary to test circuits with the power on.

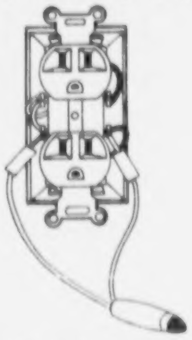
PROCEDURES AND/OR TASKS: Follow the steps to test the receptacle in order to determine the problem.

STEPS:

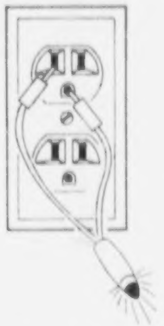
1. Insert leads of neon tester into slots of receptacle. If the tester light glows, circuit and receptacle are all right. If the tester light fails to glow, proceed to the next step.



2. Remove wall plate. Using neon tester, check the line conductors for voltage to receptacle. This is done by touching each lead of the neon tester to each terminal screw. If the tester light glows, the receptacle is defective and must be replaced. If the tester light fails to glow, proceed to the next step.



3. At times an open neutral conductor in the receptacle may be the cause of the problem. You test for this by placing one lead of the neon tester in the hot conductor (small slot of the receptacle) and the other lead of the tester in the ground slot. If the tester light glows, this indicates that the neutral is open.



4. If the tester fails to glow at steps one or three, this indicates that an open circuit is the problem. The open circuit may have occurred somewhere along the circuit wire (possibly at a previous box) or at the distribution panel.

5. Check with your instructor to determine if you have found the problem.

6. Return equipment to proper storage area.

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Troubleshooting

NAME OF JOB: Troubleshooting Electrical Switches

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to troubleshoot residential electrical problems.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to troubleshoot electrical switches.

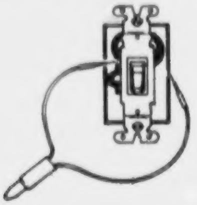
TOOLS AND EQUIPMENT: Neon tester, practice box designed by instructor

MATERIALS: No materials are needed

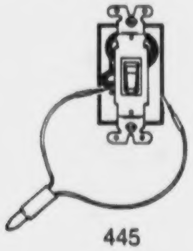
GENERAL INSTRUCTIONS: Using all safety precautions, follow the procedures listed below to test the electrical switch.

PROCEDURES AND/OR TASKS:

1. Turn switch to the "off" position.
2. Remove the cover plate.
3. Determine if there is power to the switch by touching one lead of neon tester to the metal box and the other lead to the side terminal.



4. If the tester lights, the circuit is working. If not proceed to the next procedure.
5. Turn the switch to the "on" position.
6. Touch one lead to the load terminal of switch while other lead is touching the metal box.



7. If the test light glows, the switch is alright and the fixture or wiring is faulty.

   (NOTE: Where nonmetallic boxes are used, one lead of tester must contact a neutral wire.)

8. Replace tools.

9. Clean work area.

LP-XI-4

JOB SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Troubleshooting

NAME OF JOB: Troubleshooting Electrical Fixtures

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to troubleshoot residential electrical problems.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to test an electrical fixture.

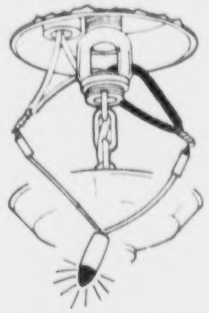
TOOLS AND EQUIPMENT: Neon tester, practice box designed by instructor

MATERIALS: No materials are needed.

GENERAL INSTRUCTIONS: Using all safety precautions, follow the procedures listed below to test the electrical fixture.

PROCEDURES AND/OR TASKS:

1. Turn off electrical power.
2. Remove electrical fixture from box.
3. With power supply to fixture exposed turn electrical power on.
4. Using neon tester check for voltage at circuit conductors.



5. If test light indicates voltage is present at the circuit conductors, the fixture is faulty.
6. If fixture is faulty, turn electrical power off, then repair or replace the fixture.
7. Replace tools.
8. Clean work area.

LP-XI-5

JOB SHEET

ELECTRICAL TRADES I

NAME:____________________________ **DATE:**____________________

UNIT: Troubleshooting

NAME OF JOB: Troubleshooting Electrical Breakers

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to troubleshoot residential electrical problems.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to troubleshoot problems with breakers.

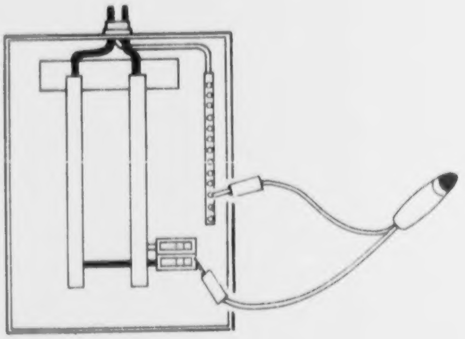
TOOLS AND EQUIPMENT: Neon tester, breaker box designed by instructor

MATERIALS: No materials are needed.

GENERAL INSTRUCTIONS: If a breaker should trip, there is a reason. You should locate the problem before resetting the breaker. However, breakers may malfunction and not reset. In this case you must test the breaker. Using all safety precautions, follow the procedures listed below to test the breakers.

PROCEDURES AND/OR TASKS:

1. Reset the breaker.
2. Place the neon tester between its terminal and neutral busbar.



3. If the results are negative (if the light does not go on) the breaker is not functioning.
4. Replace tools.
5. Clean work area.

LP-XI-6

JOB SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Troubleshooting

NAME OF JOB: Troubleshooting Electrical Fuses

UNIT OBJECTIVE: After completing this unit of instruction, the student will demonstrate the ability to troubleshoot residential electrical problems.

SPECIFIC OBJECTIVE(S): In completing this job sheet, the student will demonstrate the ability to troubleshoot problems with electrical fuses.

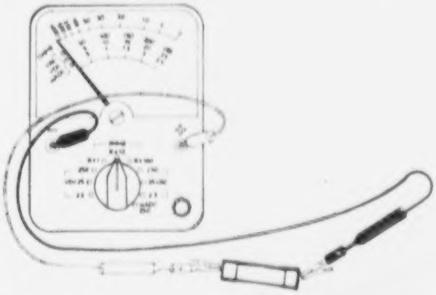
TOOLS AND EQUIPMENT: VOM, neon tester, fuse box designed by instructor

MATERIALS: No materials are needed.

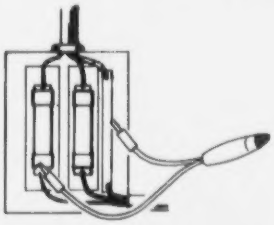
GENERAL INSTRUCTIONS: When plug fuses blow they are easily located and replaced. However, when cartridge fuses blow you must first identify the blown fuse. Using all safety precautions, follow the procedures listed below to test electrical cartridge fuses.

PROCEDURES AND/OR TASKS:

1. Remove the cartridge fuses from the panel and test them for electrical continuity using the VOM.



2. A second way of testing cartridge fuses is to use a neon tester.
   a. With cartridges still installed, test them using the neon tester.



   b. The second method is easier and quicker.

717

3. Replace tools.

4. Clean work area.

UNIT XII

COMMON ESSENTIAL ELEMENTS

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Leadership

TOPIC: Leadership Terms and Definitions

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of leadership concepts and skills.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to identify terms and definitions associated with leadership.

Below is a list of terms and definitions. Study these terms until you are comfortable in discussing what each one means.

1. **Autocratic**--having a complete power; an autocratic person forces others to do what he-she wishes.
2. **Communicate**--to get information across so that it is understood by another person.
3. **Democracy**--the practice of allowing equal participation by all members of society.
4. **Dependable**--reliable; can be counted on.
5. **Initiative**--the ability to get things done without needing to be told to do so.
6. **Leadership**--the ability to inspire confidence and loyalty so that others follow willingly in order to achieve a desired goal.
7. **Maturity**--the condition of being fully grown.
8. **Motivation**--a desire that makes you do something.
9. **Optimistic**--belief that there is more good than bad.
10. **Strength of conviction**--to make a logical decision and stick by it, even if the majority do not agree with you.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Common Essential Elements/Leadership

TOPIC: Leadership Terms and Definitions

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of leadership concepts and skills.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will identify terms and definitions associated with leadership.

REFERENCE: Student Information Sheet/Leadership Terms and Definitions

DIRECTIONS: Unscramble the following words:

1. A desire that makes you do something

   niottomavi ______________________

2. To get information across so that it is understood by another person

   mmocnuetaci ______________________

3. Belief that there is more good than bad

   pomiiittcs ______________________

4. Having the power; this person forces others to do what he/she wishes

   aatourctic ______________________

5. The ability to inspire confidence and loyalty so that others follow willingly in order to achieve a desired goal

   eeadlpihsr ______________________

6. Reliable; can be counted on

   peenddleba ______________________

7. The condition of being fully grown

   aitmruyt ______________________

8. The ability to get things done without needing to be told to do so

   iiittaveni ______________________

9. To make a logical decision and stick with it, even if the majority do not agree with you

gsnetrht fo vnoioincct ______________________________

10. The practice of allowing equal participation by all members of society

cryomeacd ______________________________

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Leadership

TOPIC: Parliamentary Procedure

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of leadership concepts and skills.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to demonstrate an understanding of parliamentary procedure.

Have you ever stopped to think about how meetings are conducted? How do those involved know what to say or when to say it? You may not be aware of it, but most meetings follow a set of rules called parliamentary procedure.

Following is an outline of information about parliamentary procedure based on Roberts Rules of Order Revised.

I. Order of Business (May vary to suit organization)

  A. Call to order or invocation

  B. Roll call--to determine if quorum is present

  C. Reading and approving minutes (general consent)

  D. Treasurer's report (placed on file)

  E. Reports of other officers (correspondence included here)

  F. Reports of executive board of committees

  G. Reports of special committees

  H. Unfinished business--anything previously before the body

  I. New business

  J. Announcements

II. Eight Essential Steps Are Followed in Obtaining Action of the House:

  A. Members

    1. Rise, address the Chair

    2. Await recognition

3. Make the motion, "I move that . . ."

4. Second the motion, "I second the motion."

B. Chair

5. States the motion, "It has been moved and seconded that . . . "

6. Calls for remarks if motion is debatable.

7. Takes the vote (called "putting the question").

8. States the result.

III. Minutes Must Have the Following Items

A. The kind of meeting (regular, special, called, etc.)

B. Name of the assembly

C. Date, time, and place of meeting

D. Fact of presence of regular chairman and secretary or substitutes, and quorum

E. Whether the minutes of the previous meeting were approved

F. All the main motions and disposition of them; points of order appeal

G. The time of meeting, adjournment, and name of recorder

H. Signature of Secretary. Word "Approved" and date of approval should be noted on the bottom of minutes by secretary. Names of those making motions should be entered, but seconder's name need not be recorded. Minutes are a record of what is "done" and not what is said.

IV. Seven Important Points About A Motion

A. Its object or use

B. Does it require a second?

C. Is it debatable?

D. Is it amendable?

E. To what motions does it yield?

F. What vote is required to carry it?

G. May it be reconsidered?

7-4

ESSENTIALS OF A GOOD MEETING

1. Be carefully planned in advance.
2. Be started and closed on time.
3. Move along with pep and enthusiasm, so members will not become bored and time will not be wasted.
4. Proceed according to the order of business.
5. Be conducted according to parliamentary procedure.
6. Include use of official opening and closing ceremonies.
7. Display chapter banner and officer banners.
8. Be held in a well-lighted, ventilated, comfortable meeting place.
9. Include well-prepared committee reports.
10. Demonstrate officers' knowledge of duties and responsibilities.
11. Hold the interest and attention of all members.
12. Provide an opportunity for member participation.
13. Teach members to work together.
14. Include both business and entertainment.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________ **DATE:** ______________________

UNIT: Common Essential Elements/Leadership

TOPIC: Planning and Conducting a Meeting

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of leadership concepts and skills.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate the ability to plan and conduct a meeting.

REFERENCE: Student Information Sheet/Parliamentary Procedure

DIRECTIONS: This is a group activity in which each class member will take part. Following procedures from Roberts Rules of Order Revised, have the students elect class officers to serve for one semester. Establish committees to meet the needs of the class. Each student will be assigned to serve on at least one committee.

Class meetings should be held as time permits following the Parliamentary Procedures given on Information Sheet.

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STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Employment

TOPIC: Employment Terms and Definitions

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills related to successful employment and/or postsecondary training.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to identify terms and definitions associated with employment and/or postsecondary training.

Below is a list of terms and definitions. Study these terms until you are comfortable in discussing what each one means.

1. **Accurate**--free from mistakes; a truthful account. Is this an accurate record of your past employment?

2. **Address**--the place where your receive your mail. Permanent address is the place where you may always receive your mail, such as your parents' address, while present address is the place you receive your mail now. What is your present address?

3. **Applicant**--one who applies fo a job. Are you one of the top applicants?

4. **Bondable**--usually refers to the right to be insured. People who handle large sums of money are sometimes asked to be insured against theft or embezzlement. If offered this job, would you be bondable?

5. **Character**--usually refers to such personality traits as honesty, dependability, loyalty, etc. Could you name three character references? (This means could you name three people who could verify your personality traits?)

6. **Chronic**--keeps coming up; recurring; usually relates to an illness, such as diabetes or epilepsy, which requires medication. Do you have any chronic illness?

7. **Compensation**--payments; usually refers to payment due to an injury on the job (worker's compensation) or payment due to being out of a job (unemployment compensation). Have you collected worker's compensation in the last two years?

8. **Confidential**--refers to being kept a secret or private. You can be sure that the information concerning your past employment will be confidential.

9. **Convicted**--to be proved guilty by a judge or jury of a crime. Have you ever been convicted of a felony?

10. **Dependents**--persons who rely upon you for support; usually refers to the number of children you have. How many dependents do you have?

11. **Disability**--usually refers to not being able to work because of an injury; insurance may be taken out which will provide a check if you are unable to work. The insurance is paid either by the employee or the employer. Have you claimed any disability insurance in the last year?

12. **Eligible**--able or worthy of being chosen. Are you eligible for employment at this time?

13. **Emergency**--an unexpected act causing a need for some type of action right away. Who should be notified in case of an emergency?

14. **Employer**--the person or business for whom a person works. Who was your previous employer?

15. **Excluding**--to leave out; not include. How many jobs have you held, excluding your present job?

16. **Fee**--a set amount of money you must pay for certain services. Would you be willing to pay a small fee for our services?

17. **Felony**--a federal crime for which punishment may be death or imprisonment for more than one year. Have you ever been convicted of a felony?

18. **Institution**--a place where you may receive formal training or education. What is the name of the institution from which you received your diploma?

19. **Insurance**--coverage against a loss; usually refers to health/life insurance, unemployment insurance, and disability insurance. Have you collected unemployment insurance in the last year?

20. **Legibly**--written in a way which can be read. Your application should be typed or written legibly.

21. **Maiden name**--the last name of a woman before she is married. What is your maiden name?

22. **Marital status**--refers to being single, married, separated, or divorced. What is your marital status?

23. **Misdemeanor**--a crime less serious than a felony. Have you ever been convicted of a misdemeanor?

24. **Misrepresented**--to give a false or misleading statement; usually appears at the end of a job application before the signature. I certify that the above statements are true, and in no way is any information misrepresented.

25. **Naturalized**--to become a citizen. On what date were you naturalized?

26. **Not applicable**--does not apply to you; usually expressed as N/A. If the information does not apply to you, please write N/A.

27. **Omission**--the state of being left out or blank; usually as an error. If you do not write the term N/A in a blank, the employer will think it was an omission on your part.

28. **Optional**--having a choice. Listing your age on the application is optional.

29. **Personal**--belonging to you; usually refers to information about your height, weight, marital status, age, etc. Please include all personal data on the first page.

30. **Personnel**--a group of persons belonging to an organization. A personnel director is usually in charge of hirings, firings, disagreements, etc. The personnel in this business are young, energetic individuals.

31. **Probationary**--a period of time during which a company sees if you can do the job you were hired for. You realize that there is a probationary period of six months.

32. **Qualified**--having the skill, training, and/or education to do a job. Why do you feel you are qualified?

33. **Reference**--someone who can be asked to file an answer to questions about a person's ability to do a job; usually there are two types of reference: past employers and character references. Please name three references.

34. **Relatives**--people who are related to you. Do you have any relatives working here?

35. **Reverse side**--on the other side. Please include any additional information on the reverse side.

36. **Salary**--usually refers to a fixed amount of pay not directly related to the number of hours you work. What is the beginning salary?

37. **Sex**--refers to being male or female. To what sex do you belong?

38. **Signature**--a person's name, written in longhand. Please read the application and include your signature at the bottom.

39. **Spouse**--depending on your sex, your husband or wife. What is your spouse's occupation?

40. **Wage**--usually refers to the amount of money you earn during an hour. What is the minimum wage?

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Common Essential Elements/Employment

TOPIC: Employment Terms and Definitions

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills related to successful employment and/or postsecondary training.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will identify terms and definitions associated with employment and/or postsecondary training.

REFERENCE: Student Information Sheet/Employment Terms and Definitions

DIRECTIONS:

1. Make a copy of Student Information Sheet/Terms and Definitions.
2. Cut out each item along the lines.
3. Place the slips of paper in either a hat or box for drawing purposes.
4. Divide the class into two groups. They should stand on opposite sides of the room.
5. Each group should invent a clever name. Write the names of the groups on the board.
6. Each student will draw a slip of paper and immediately give it to the teacher.
7. The teacher will say the word that appears on the slip. The student will then define the word and use the word in a sentence to the satisfaction of the teacher. A mark is placed by the group's name each time a student defines the word correctly.
8. The other group will follow steps six and seven.
9. When all words have been used, the group with the most marks will be declared the winner.

COPIES OF THIS ACTIVITY COULD BE MADE FOR ALL STUDENTS TO EASE ANY MISUNDERSTANDINGS. HOWEVER, THE TEACHER MAY WANT TO READ THE DIRECTIONS TO THE CLASS.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Entrepreneurship

TOPIC: Entrepreneurship Terms and Definitions

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills related to successful employment and/or postsecondary training.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to identify terms and definitions associated with entrepreneurship.

Below is a list of terms and definitions. Study these terms until you are comfortable in discussing what each one means.

1. **Achievement**--something achieved by skill, work, courage, etc.

2. **Capital**--money or property, especially when used in business to make more money.

3. **Capitalism**--economic and political system in which people privately own goods and investments and where the production, distribution, and sale of goods is based on competition in a free market.

   (NOTE: Capitalism is interchangeable with the term free enterprise.)

4. **Capital resources**--the basic "tools" used to change raw materials into goods and services.

5. **Communism**--economic and political system in which the government owns and controls all private and state means of production and distributes economic goods among the people as needed; no private or state ownership exists in a communistic society.

6. **Courage**--the quality of being able to control one's fear; bravery.

7. **Creativity**--ability to create, having imagination and ability.

8. **Curiosity**--a strong feeling of wanting to know or learn.

9. **Demand**--amount of goods and services a customer will want to buy.

10. **Entrepreneurship**--the organizing, managing, and operating of a small business by an individual.

11. **Free enterprise**--the right to start and manage a business, compete with other businesses, and seek a profit, providing it is not forbidden by law.

12. **Independence**--freedom from the control of others.

13. **Inventory**--a complete list of goods or property; the stock of goods on hand.

14. **Labor force**--all people 16 years or older employed as civilians laboring more than 15 hours a week for wages; also those workers who are unemployed and the armed forces.

15. **Licenses**--a paper, card, etc. showing that one is permitted by law to do something.

16. **Partnership**--a business firm made up of two or more partners.

17. **Permit**--a paper, card, etc. showing permission.

18. **Personality traits**--all the special qualities which make a person different from other people.

19. **Profit**--money remaining after all costs of operating a business are paid.

20. **Regulation**--a rule or law that regulates.

21. **Self-confidence**--sure of oneself, confident of one's own ability.

22. **Socialism**--economic and political system in which there is collective government ownership and control of most means of production and distribution of goods.

23. **Supply**--amount of goods and services that will be offered for sale.

24. **Technology**--applying service for the practical purpose of producing more and better goods and service for industrial uses.

25. **Wages**--usually refers to the amount of money you earn during an hour.

26. **Zoning**--a section of a city set apart by law for a particular use, as for homes or for business.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:_______________________________ **DATE:**______________________

UNIT: Common Essential Elements/Entrepreneurship

TOPIC: Entrepreneurship Terms and Definitions

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills related to successful employment and/or postsecondary training.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will identify terms and definitions associated with entrepreneurship.

REFERENCE: Student Information Sheet/Entrepreneurship Terms and Definitions

DIRECTIONS: Find the words that best fit the descriptions at the bottom of this page. Circle your answers.

X	K	L	O	R	U	S	M	U	B	D	C	T	Q	R	T	O	N	M	V
R	M	B	X	S	N	I	V	S	O	C	I	A	L	I	S	M	B	U	S
M	C	D	M	B	R	S	L	K	G	A	B	D	E	N	S	O	V	N	O
N	A	E	N	S	L	K	G	H	V	I	N	G	R	I	E	D	S	L	N
L	P	B	D	P	R	O	F	I	T	A	G	B	N	K	G	A	Y	U	P
P	I	G	L	K	N	S	T	M	O	L	G	U	O	F	X	G	O	L	M
R	T	B	C	D	K	L	N	G	B	V	M	T	S	G	O	T	V	U	R
Z	A	E	A	C	D	B	E	L	G	M	K	B	D	L	Y	R	O	X	L
M	L	B	G	H	L	M	C	K	O	R	T	Z	O	N	L	V	C	O	V
V	I	E	G	A	G	B	L	C	F	G	I	N	M	K	H	I	G	E	S
O	S	U	P	P	L	Y	A	B	A	I	H	O	H	B	K	C	B	L	N
P	M	V	L	R	T	S	R	N	G	C	L	K	M	C	G	M	D	K	C
K	G	M	K	B	D	E	T	E	E	A	G	P	I	G	A	L	E	M	A
H	S	R	M	L	V	K	L	T	L	K	R	E	S	O	U	R	C	E	S
G	Z	N	T	X	U	R	V	K	E	L	D	A	G	K	O	L	S	O	B
I	B	D	E	H	R	X	N	I	O	M	E	C	M	T	S	R	T	R	D
O	A	D	E	M	A	N	D	G	N	G	H	B	S	V	L	M	V	T	R
R	N	S	R	V	Z	Y	A	C	D	K	M	O	Z	T	U	C	D	E	A
V	X	Z	O	L	U	E	B	E	N	T	E	R	P	R	I	S	E	B	K
T	S	V	U	W	L	K	G	L	K	S	A	S	I	U	D	E	S	L	M

1. Economic and political system in which the people privately own goods and investments and where the production, distribution, and sale of goods is based on competition in a free market.

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2. All people 16 years or older employed as civilians laboring more than 15 hours a week for wages and those workers who are unemployed and the armed forces make up the labor ______________________.

3. Capital ____________________ are the basic "tools" used to change raw materials into goods and services.

4. Amount of goods and services a customer will want to buy.

5. Free _________________________ is the right to start and manage a business, compete with other businesses, and seek a profit, providing it is not forbidden by law.

6. Applying service for the practical purpose of producing more and better goods and services for industrial uses.

7. Amount of goods and services that will be offered for sale.

8. Money remaining after all costs of operating a business are paid.

9. Economic and political system in which the government owns and controls all private and state means of production and distributes economic goods among the people as needed; no private or state ownership exists in a communistic society.

10. Economic and political system in which there is collective or government ownership and control of most means of production and distribution of goods.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Entrepreneurship

TOPIC: What Is Entrepreneurship?

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills related to successful employment and/or postsecondary training.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to demonstrate an understanding of entrepreneurship.

What Is an Entrepreneur?

Entrepreneurship is the organizing, managing, and operating of a small business. Not everyone is suited to being an entrepreneur. Individuals whose personality traits involve need for achievement, need for independence, self-confidence, high level of activity, courage, curiosity, and creativity may choose to become entrepreneurs.

Why Should You Start a Company?

There are many different reasons for starting your own business. Entrepreneurship may be a way for you to make more money than you could if you worked for someone else. It also provides you with a chance to do something different. As an entrepreneur you can use your own ideas. You may also be recognized as a professional. Finally, you may just like being your own boss.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT:	Common Essential Elements/Entrepreneurship
TOPIC:	Am I an Entrepreneur?
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate an understanding of concepts and skills related to successful employment and/or postsecondary training.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will demonstrate an understanding of what it takes to be an entrepreneur.
REFERENCE:	Student Information Sheet/What Is Entrepreneurship?
DIRECTIONS:	Under each question, check the answer that says what you feel or comes closest to the way you feel. Be honest with yourself.

Are you a self-starter?

____ I do things on my own. Nobody has to tell me to get going.

____ If someone gets me started, I keep going all right.

____ Easy does it. I don't put myself out until I have to.

How do you feel about other people?

____ I like people. I can get along with just about anybody.

____ I have plenty of friends--I don't need anyone else.

____ Most people bother me.

Can you lead others?

____ I can get most people to go along when I start something.

____ I can give orders if someone tells me what we should do.

____ I let someone else get things moving. Then I go along if I feel like it.

Can you take responsibility?

____ I like to take charge of things and see them through.

____ I'll take over if I have to, but I'd rather someone else be responsible.

____ There's always some eager beaver around waiting to show how smart he/she is. I say, "Let 'em."

How good an organizer are you?

____ I like to have a plan before I start. I'm usually the one to get things lined up when friends want to do something.

____ I do all right unless things get fouled up. Then I disappear.

____ You get ready and then something comes along and stops the plan. So, I just take things as they come.

How good a worker are you?

____ I can keep going as long as I am needed. I don't mind working for something I want.

____ I'll work hard for a while, but when I've had enough, that's it!

____ I can't see that hard work gets you anywhere.

Can you make decisions?

____ I can make up my mind in a hurry if necessary. It usually turns out O.K., too.

____ I can, if I have plenty of time. If I have to make up my mind fast, I think later that I should have decided the other way.

____ I don't like to be the one who has to decide things. I'd probably ruin it.

Can people trust what you say?

____ Yes, they can. I don't say things I don't mean.

____ I try to be honest most of the time, but sometimes I just want what is easiest.

____ What does it matter if the other person doesn't know the difference?

Can you stick with it?

____ If I make up my mind to do something, I don't let anything stop me.

____ I usually finish what I start--if it doesn't get fouled up.

____ If it doesn't go well right away, I stop. Why beat your brains out?

How good is your health?

____ I never run down!

____ I have enough energy for most things I want to do.

____ I run out of energy sooner than most of my friends seem to.

Now count the checks you made.

____ How many checks are beside the first answer to each question?

____ How many checks are beside the second answer to each question?

____ How many checks are beside the third answer to each question?

If most of your checks are beside the first answer, you probably have what it takes to run a business. If not, you're likely to have more trouble than you can handle by yourself. Better find a partner who is strong on the points you are weak on. If many checks are beside the third answer, not even a good partner could make your business a success.

Source: The High School Student in the Working World. A Handbook for Counselors. Texas Education Agency, Austin, Texas, July, 1981.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Entrepreneurship

TOPIC: Getting Started

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills related to successful employment and/or postsecondary training.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to demonstrate an understanding of how to start a business.

What Do You Need to Know?

What types of information would you need to start a business? There are general areas you should know about. Prior to starting a business, you should learn all you can about that specific type of business. Talk with an accountant or financial advisor in order to determine how much money or capital you will need to get started. Be aware that a good business location is of primary importance. There are questions you should ask yourself. How will you manage your inventory? What will your credit policy be? How much money can you afford to take out of the business? How could your business be expanded? Careful consideration should be given to all aspects.

Steps in Starting a Business

There are steps you should take in starting a new business. Establish a checking account with a commercial bank. It may be necessary to obtain a business loan. Think about what type of ownership you want. If you want or need a partner, select one carefully. Draw up a partnership agreement. Study the regulations which apply to the type of business you wish to start. Be sure to check the federal, state and county or city regulations.

If you are unsure about some area of business ownership, ask others who know. Areas such as insurance, taxes, record-keeping systems, and advertising may require outside assistance.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT: Common Essential Elements/Entrepreneurship

TOPIC: Starting Your Own Business

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills related to successful employment and/or postsecondary training.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of how to start a business.

REFERENCE: Student Information Sheet/Getting Started

DIRECTIONS: Have you ever considered having your own business? Do you think it would be easier or harder working for someone else? This activity will help you experience both the good and bad points of being an entrepreneur. First, consider your classmates as your business partners. Can you and your partners think of a product that can be sold in your school or perhaps a service you and your partners can provide for others? If so, you are on the right track to starting your own business and being an entrepreneur! Below is a list of steps to follow for small business success. You should realize, however, that if you were starting an actual business, there would be many more steps to follow.

STEPS FOR SMALL BUSINESS SUCCESS

1. Decide what type of product or service you will sell.
2. Decide approximately how many people you expect will buy your product or want the service you are willing to provide.
3. Decide if your are selling a product and whether you will make it or buy it from another company.
4. Decide what supplies will be needed to start your business.
5. Decide how much money will be needed to start your business.
6. Decide where you will get the money needed to start your business.
7. Figure the amount you will charge for your product or service in order to make a profit.
8. Decide when and where you will sell your product or provide your service.
9. Make sure that both the time and place you are selling your product or providing your service are convenient for others.

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10. Agree on the name of your business.

11. Plan how you will advertise.

12. Decide how and who will keep track of the books. (inventory, money paid out, money taken in, etc.)

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Common Essential Elements/General Shop Safety

TOPIC: Personal and Group Safety

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to identify safe working practices.

Safety in the shop includes a knowledge of safety rules, proper attitudes regarding safety, personal safety, group safety, knowledge of clothing and personal protective equipment, and safe operation of equipment. Personal and group safety are good places to start when learning how **YOU** are affected by safe working practices.

Safety in simple terms means **FREEDOM FROM ACCIDENTS**. The Occupational Safety and Health Act of 1970 (OSHA) assures every working man or woman in the nation safe and healthful working conditions and the preservation of our human resources **(YOU THE WORKER)**. OSHA encourages the organization of accident-prevention programs in school shops.

In order to understand personal safety in the shop, you must develop a safe **ATTITUDE** about safety. A proper attitude is a must in any shop. Accidents do not happen by themselves. Most accidents are caused by thoughtlessness. It is important that you be alert while in the shop and be on guard against accidents at all times. Visiting should be avoided because it distracts from a person's alertness, which makes the individual accident-prone.

Personal safety involves protecting yourself from injury caused by your actions. By becoming aware of unsafe conditions and practices, you can protect yourself and others. When a number of individuals are working safely together you have **GROUP SAFETY**. This includes your entire class. Since every student's actions can affect someone else, it is important that **YOU** not only work safely, but that you stress the importance of classroom safety to your classmates.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:________________________________ **DATE:**________________________

UNIT: Common Essential Elements/General Shop Safety

TOPIC: Personal and Group Safety

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will be able to identify safe working practices.

REFERENCE: Student Information Sheet/Personal and Group Safety

DIRECTIONS: Read and complete each of the following statements about safety by filling in the blank.

1. In simple terms safety means freedom from______________.
2. You must develop a safe ____________about safety in order to understand personal safety in the shop.
3. Safety in the shop includes a knowledge of safety rules, proper______________regarding safety, ______________safety, group safety, knowledge of clothing and personal protective equipment, and safe operation of equipment.
4. Most ____________are caused by thoughtlessness.
5. The term OSHA stands for the __________ __________ and __________ __________ of 1970.
6. It is important that you be __________ while in the shop and be on guard against accidents at all times.
7. Visiting should be __________ because it distracts from a person's alertness, which makes the individual ____________-______________________.
8. Personal safety involves protecting yourself from _____ caused by your actions.
9. By becoming aware of unsafe ______and ______ , you can protect yourself and _______.
10. Since every student's ______can affect someone else, it is important that ______ not only work safely, but that you stress the importance of classroom safety to your _______.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Common Essential Elements/General Shop Safety

TOPIC: Work Safety in the Shop

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will demonstrate a knowledge of safe working practices.

There are numerous safety rules which should be followed when working in the shop. These might be thought of as **SAFETY COMMANDMENTS**. Listed below are a number of safety commandments which will need to be followed while working in the shop.

SAFETY COMMANDMENTS

1. Avoid wrestling, throwing objects, and general horseplay.
2. Provide a place for everything, and keep everything in its place.
3. Keep your arms and back as nearly straight as possible when lifting heavy objects.
4. Never place objects on high places because they may fall and cause injuries.
5. Do not leave slippery substances on floors because they may cause people to fall.
6. Keep all work spaces clean of all materials to avoid stumbling or falling.
7. Remove or bend down all protruding nails to eliminate the hazard of their being stepped on or brushed against.
8. Notify your instructor of any known violations of safety rules or of conditions you think may be dangerous.
9. When loading trucks, always cross-stack the load at intervals .
10. Inspect ladders before use. Remove any faulty ladders from use.

    (**NOTE**: Never paint a ladder since paint can hide cracks or faults.)
11. When using a ladder, be sure the bottom rests on solid ground.
12. Be familiar with the correct methods of erecting a scaffold.
13. Replace faulty tools and equipment.

14. Immediately report all accidents and report for first-aid treatment.

15. Do not take chances!

Work safety in the shop also includes the use of proper clothing and protective equipment. Your clothes should fit well and be kept in proper repair. Ragged sleeves, neckties, or loose clothing may become caught in equipment, causing an accident or injury. While working in the shop, you should roll your shirt sleeves above your elbows and wear thick-soled work shoes for protection against sharp objects. When handling rough materials or sharp edges, always wear gloves. You can also protect yourself by wearing a hard hat or cap and by keeping your hair trimmed to avoid getting it caught in rotating machinery. It is important that you protect your eyes at all times. Be sure to wear safety goggles around abrasive, scraping, or sawing equipment. Protect your lungs by wearing a dust mask or respirator when working in dusty areas or spray painting areas.

Remember work safety in the shop protects you as well as those you work with.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Common Essential Elements/General Shop Safety

TOPIC: Work Safety in the Shop

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate a knowledge of safe working practices.

REFERENCE: Student Information Sheet/Work Safety in the Shop

DIRECTIONS: Carefully read the student information sheet "Work Safety in the Shop." Then read each statement below. If the statement is true, circle the "T"; if false, circle the "F."

T F 1. There is no harm in taking chances while in the shop.

T F 2. When using a ladder, be sure the bottom rests on solid ground.

T F 3. Notify your instructor of any known violations of safety rules or conditions you think may be dangerous.

T F 4. Place objects on high shelves to get them out of the way.

T F 5. Keep your tools wherever they are handy to you.

T F 6. Safety belts are not needed if the scaffold is erected correctly.

T F 7. Immediately report all accidents and report for first-aid treatment.

T F 8. Save faulty tools and equipment; you may need them.

T F 9. Remove or bend down all protruding nails to eliminate the hazard of their being stepped on or brushed against.

T F 10. Keep your arms and back as nearly straight as possible when lifting heavy objects.

T F 11. You should wear loose fitting clothing in the shop because it is more comfortable.

T F 12. Gloves should be worn when handling rough materials or sharp edges.

T F 13. Be sure to wear safety goggles around abrasive, scraping, or sawing equipment.

T F 14. You need only wear a dust mask or respirator if you will be working in a dusty area or spray painting area for a long period of time.

T F 15. Do not worry about wearing a hard hat or cap in the shop unless you are actually working.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Common Essential Elements/General Shop Safety

TOPIC: Fire Safety

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will apply safe working practices and demonstrate a knowledge of fire safety.

Fire safety is an important aspect of general shop safety. Would you know what to do in case of a fire? Being prepared is an important part of being safe. In order to be prepared in case of a fire, you must first be aware of the types of fires you may encounter and how these fires are controlled.

Fire prevention is a form of fire safety. By practicing fire prevention, you may be able to avoid a fire in the shop. Shops should be kept clean and flammables stored properly. Look around your shop carefully so that you will know the correct way to leave the building in case of fire. If there is not a plan posted by the door of how to leave the building in case of fire, ask your instructor for these instructions. Be serious about fire drills because these may save your life.

If a fire should start in the shop, it is important that you know the location of the fire alarm. You should find out what materials are burning in order to know what type of fire it is. There are three types of fires; these are:

Class A--Ordinary combustibles such as wood, paper, or cloth.

Class B--Flammable liquids or grease such as gasoline, paints, or oils.

Class C--Electrical equipment such as motors and switches.

Putting out a fire is not as simple as using a fire extinguisher. There are different types of fire extinguishers, just as there are different types of fire. Below is a list of fire extinguishers, where to use them, and how to use them.

TYPES OF FIRE EXTINGUISHERS

Foam fire extinguishers are used on Class A and B fires. To use, turn extinguisher upside down and spray so that foam falls on the fire.

Carbon dioxide fire extinguishers are used on Class B and C fires. To use, squeeze handle, spray near the fire base and move upward.

Soda acid fire extinguishers are used on Class A fires. To use, turn extinguisher upside down and spray at base of the fire.

Water fire extinguishers are used on class A fires. To use, squeeze handle and spray at base of the fire. **(NOTE**: A water hose or bucket may also be used.)

Prevention is the best method of dealing with fire. Small or localized fires may be contained by using one of the fire extinguishers shown above. However, **BUILDING EVALUATION** will help assure your safety in case of a fire. Windows and doors should be closed when evacuating a building. (Someone should be assigned to do this.) Make sure everyone leaves quickly but in an orderly manner. Move away from the building, and wait for instructions from your teacher or other school personnel.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:________________________________ **DATE:**_______________________

UNIT: Common Essential Elements/General Shop Safety

TOPIC: Fire Safety

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will apply safe working practices and demonstrate a knowledge of fire safety.

REFERENCE: Student Information Sheet/Fire Safety

DIRECTIONS: Draw a sketch of your classroom and building. Include such details as hallways, doorways, fire escapes, windows, stairways, and other important features. Use a dark pen to draw dotted lines and arrows showing the best paths to take when leaving the building during a fire. Write any notes on the drawing that you feel might tell a person what to do or to expect during a fire. You may wish to look at your school evacuation plan posted in your classroom to see if it agrees with yours. At the bottom of your evacuation plan, list and explain the three classes of fire. Also list the correct types of fire extinguisher to be used for each and how they should be used.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Common Essential Elements/General Shop Safety

TOPIC: Safety with Hand and Power Tools

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to demonstrate skills in working safely and apply safety to the use of hand and power tools.

While working in the shop, you will have the opportunity to use hand and power tools. Before you attempt to use any type of tool, it is important that you learn to use the tools safely.

To simplify learning, we have divided the shop tools into two types: **HAND TOOLS**--those tools which are operated by hand, and **POWER TOOLS**--those tools which are operated by other sources of power such as electricity, gasoline, battery, compressed air, etc.

When working with any type of tool, you must focus your full attention on the work you are doing. Learn to use the tool correctly, and only use it for the job it is intended to be used for. You should have a place for each tool, and tools should be kept there when not in use. Tools work best when they are kept in their best condition. Be sure to clean tools after you use them, and sharpen tools as needed. Do not try to use a tool which has been broken or damaged.

When working with sharp-edged tools, be sure to cut away from your body. Keep tools away from the edge of a bench or work area. Injuries can occur from tools falling off of benches or work areas. Carry sharp-pointed tools with the point or cutting edge down.

There are special rules which must be followed when working with power tools. These include personal readiness along with a knowledge of power tool safety. Before operating any power tool, do a self-check. Make sure your hands are dry; remove ties, rings, or wristwatches; roll up long sleeves; and secure hair (tied back and under a cap). Listed below are steps to follow in operating power tools safely.

OPERATING POWER TOOLS SAFELY

1. Keep your attention focused on the work.
2. Know and understand all of the manufacturer's safety recommendations.
3. Be familiar with the operation procedures of the tools.
4. Inspect electrical cords to see that they are in good condition.
5. Power tools should be inspected and serviced at regular intervals by qualified repair people.

6. Be sure all power tools are grounded with three-wire conductor cord when required.

7. Do not leave electrical cords where they may be run over or damaged.

8. Make all adjustments and inspections with the power **OFF** and the cable **DISCONNECTED**.

9. Before connecting to a power source, be sure that the switch is in the **OFF** position.

10. Be sure that all safety guards are in place and in working order.

11. Wear safety goggles and a dust mask when the work requires.

12. Be sure that the materials to be worked are free of obstructions and are securely clamped.

13. Change in sound during power tool operation normally indicates trouble and should be investigated immediately.

14. When work is complete, shut off all power tools.

15. When work is complete, disconnect the power tools from the power source.

16. After the tools are disconnected, remove blades, bits, or any other cutter from the wood.

17. Store power tools and blades, bits, or other cutters in their proper places.

18. When the power tool is defective, remove it from service.

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ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Common Essential Elements/General Shop Safety

TOPIC: Safety with Hand and Power Tools

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate a knowledge of the concepts and skills associated with safe working practices.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate skills in working safely and apply safety to the use of hand and power tools.

REFERENCE: Student Information Sheet/Safety with Hand and Power Tools

DIRECTIONS: Read each of the following statements regarding safety with hand and power tools. Circle the word needed to make the statement correct.

1. Hand/Power tools are tools which are operated by hand.
2. Hand/Power tools are operated by other power sources such as: electricity, gasoline, battery, compressed air, etc.
3. In working with any type of tool, you must focus your full attention/energy on the work you are doing.
4. Tools work only/best when they are kept in their best condition.
5. Before operating any power tools, make sure your hands are dry/clean/wet.
6. Make all adjustments and inspections of tools with the power on/off and the cable disconnected.
7. When work is complete, turn on/off all power tools.
8. Be sure all power tools are grounded with two-wire/three-wire conductor cord when required.
9. Do not/Do leave electrical cords where they can be run over or damaged.
10. Before connecting to a power source, be sure that the switch is in the off/on position.

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Human Relations and Personality Development

TOPIC: Terms and Definitions for Human Relations and Personality Development

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills associated with human relations and personality development.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to identify terms and definitions associated with human relations and personality development.

Below is a list of terms and definitions. Study these terms until you are comfortable in discussing what each one means.

1. **Ability**--the power or means to do something.
2. **Aptitude**--an ability that you have naturally; quickness to learn or understand.
3. **Attitude**--the way you act in a certain way to a given situation.
4. **Characteristic**--a quality about yourself which distinguishes you from others.
5. **Environment**--your surroundings.
6. **Interest**--something to which you give special attention.
7. **Leadership**--having those qualities needed to guide or direct others.
8. **Personality**--all the characteristics combined that make you the person you are.
9. **Trait**--a special quality that makes you an individual.
10. **Unique**--something that is completely different from anything else.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:_________________________________ **DATE:**_______________________

UNIT: Common Essential Elements/Human Relations and Personality Development

TOPIC: Terms and Definitions for Human Relations and Personality Development

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills associated with human relations and personality development.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will identify terms and definitions associated with human relations and personality development.

REFERENCE: Student Information Sheet/Terms and Definitions for Human Relations and Personality Development

DIRECTIONS: Complete the sentences below by using one of the following words. Then, locate the word used in the word find.

Ability
Trait
Unique
Leadership
Environment
Aptitude
Interest
Characteristic
Personality
Attitude

1. When you give something special attention, it could be said you have a(an) ________________ in it.

2. A special quality that makes you an individual is known as a(an) ________________.

3. Having those qualities needed to guide or direct others is known as ________________.

4. An ability that you have naturally is a(an) ________________.

5. All the characteristics combined that make you the person you are is known as ________________.

6. Your surroundings can also be known as your ________________.

7. The way you act in a certain way to a given situation is known as a(an) ____________________.

8. When you have the power or means to do something, it can be said that you have the ____________________.

9. When something is completely different from anything else, it is ____________________.

10. A quality about yourself which distinguishes you from others is a(an) ____________________.

S	R	Y	U	I	V	O	P	E	D	F	V	B	W	M	I	T	G	A	C
E	B	A	X	U	M	K	L	N	U	B	Q	P	R	E	C	D	T	E	B
C	V	B	L	E	A	D	E	R	S	H	I	P	K	M	N	O	W	I	T
B	U	I	M	N	O	P	W	V	B	S	R	T	P	K	T	S	C	P	O
Z	Q	I	T	M	W	K	T	I	S	O	B	D	C	A	I	W	I	E	T
R	K	I	R	L	V	C	M	I	N	T	E	R	E	S	T	Q	W	R	V
A	I	B	A	D	K	I	P	G	T	O	M	W	U	I	C	B	C	S	L
Z	P	C	I	T	U	K	F	N	G	U	C	V	K	G	N	U	Y	O	A
D	W	E	T	K	I	G	H	O	P	I	D	Q	U	H	P	E	V	N	M
W	B	O	Z	G	L	M	E	T	A	S	N	E	S	O	Z	I	Y	A	P
R	B	W	C	H	A	R	A	C	T	E	R	I	S	T	I	C	Q	L	E
B	A	N	K	I	O	P	E	R	I	V	X	C	W	U	O	V	Q	I	B
C	B	R	I	O	U	C	P	E	N	V	I	R	O	N	M	E	N	T	S
O	I	N	P	T	Y	K	U	L	M	I	O	E	S	P	R	V	B	Y	Z
V	L	U	D	G	H	Q	W	S	V	O	B	M	S	W	I	K	N	C	N
S	I	X	Q	K	I	P	A	T	T	T	I	T	U	D	E	Q	B	K	P
W	T	B	E	N	W	P	R	T	Y	K	G	B	W	D	I	N	G	K	O
G	Y	B	U	C	O	T	N	G	O	M	E	K	L	S	D	A	V	E	B
K	E	Q	S	E	I	V	M	C	X	W	C	S	Q	I	Y	R	E	W	O
W	S	D	C	I	G	T	W	S	I	P	V	N	I	F	E	K	G	Y	N

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT:	Common Essential Elements/Human Relations and Personality Development
TOPIC:	Getting to Know Yourself
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate an understanding of concepts and skills associated with human relations and personality development.
SPECIFIC OBJECTIVE(S):	After completion of this information sheet, the student will be able to demonstrate an understanding of the importance of getting to know yourself.

Why Understanding Yourself Is Hard to Do

Have you ever wondered why it is difficult to understand yourself? People as a rule are hard to understand. You are made up of many TRAITS and CHARACTERISTICS. If you are like most people, you most likely have not taken the time to appraise (evaluate) yourself. Each person has a different type of personality. Your personality is created by many factors. These include your family, your friends, your experiences, and your environment. You cannot compare the total you to anyone else--you are unique.

Relating Understanding Yourself to Career Choice

Being unique means that the career you choose will most likely be different from any chosen by your friends. Merely choosing a career because someone you know has that career does not mean that it will be the best for you. You need to be aware of your personal characteristics. Keep in mind both your good and bad qualities. Understanding yourself will play an important part in making a career choice that is best for you.

What About You Influences Your Career Choice?

Every individual has various qualities which influence his/her career choice. Self-concept is one of these qualities. Self-concept involves how you see yourself, how others see you, and how you would like to be. Lifestyle needs and work needs will play a part. Other aspects to be considered include personality, interests, abilities, attitudes, aptitudes, leadership traits, and the ability to change and/or accept change.

Understanding Yourself

There are many ways of learning about yourself. Tests have been developed which assess personality, interests, abilities, attitudes, aptitudes, etc. The better you understand yourself, the better you will be able to understand others.

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ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Common Essential Elements/Human Relations and Personality Development

TOPIC: Self-Concept Checklist

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills associated with human relations and personality development.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of self-concept.

REFERENCE: Student Information Sheet/Getting to Know Yourself

DIRECTIONS: Read each sentence carefully. There are no right or wrong answers. Just mark how you really feel about yourself. Y-Yes; N-No; NS-Not Sure.

___ I like myself.

___ I often get angry.

___ I can read fairly well.

___ People can depend on me.

___ I am a very shy person.

___ I get into lots of fights.

___ I am afraid of many things.

___ I am good in spelling.

___ I have many friends.

___ I tell the truth.

___ I look OK.

___ Sometimes I am clumsy.

___ I often feel sick.

___ I am good in arithmetic.

___ My handwriting is good.

___ I am successful most of the time.

___ Other people often laugh at me.

___ Most of the time I enjoy helping others.

___ I have a hard time making up my mind.

___ I like to be with my friends.

___ I am sad and depressed sometimes.

___ I would like to be someone else.

___ I like school most of the time.

___ I wish I lived somewhere else.

___ I am often nervous and upset.

___ I am good at sports and games.

___ Most people dislike me.

___ I am a happy person most of the time.

___ Other kids like to play with me.

1. Go back over your answers. Are you happy with the results? Are you happy about the way you feel about yourself? Are you happy about the way others feel about you?
2. Is there a pattern to your answers?
3. Will your answers influence the career you choose? Why or why not?
4. Would you change anything about yourself? If so, what?
5. How would you describe your self-concept?
6. If you have a negative self-concept, will it influence your ability to succeed?

STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Personal and Business Management

TOPIC: Terms and Definitions for Personal and Business Management

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of the concepts and skills related to personal and business management.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to identify terms and definitions associated with personal and business management.

Below is a list of terms and definitions. Study those terms until you are comfortable in discussing what each one means.

1. **Bank statement**--a report sent to the customer that includes a record of all deposits, a list of all checks that have been paid by the bank, all bank charges, and canceled checks.
2. **Canceled check**--a check that has been paid by the bank. The check is then returned to you with the bank statement.
3. **Certified check**--a type of guaranteed check; the bank stamps the personal check of a customer, then holds the amount of the check from the customer's account until the check is cashed.
4. **Collateral**--something of value held by a bank as security to guarantee repayment of a loan.
5. **Counterfeit bill**--money made by an individual but not approved by the U.S. government. You can tell the difference by holding a bill to the light. If the bill has blue and red thread-like lines in it, it is a genuine bill.
6. **Denomination**--value or size of a piece of money.
7. **Deposits in transit**--deposits that were recorded on the account holder's check register but were not processed at the bank in time to be included on the bank statement.
8. **Endorsement**--signature on the back of a check that allows it to be cashed or deposited.
9. **Gross National Product**--the total value of products that are produced in this country.
10. **Interest rate**--the amount of money charged for borrowed money; the amount paid to a depositor for money in a savings account.
11. **Inflation**--an increase in the amount of money and credit available to purchase goods, without an increase in the amount of goods available, resulting in a rise in the general price of goods.
12. **Loan**--money borrowed with promise to pay.
13. **Needs**--something that is necessary or required for your well-being.

14. **Overdraft**--the total amount of checks written on an account is more than the amount deposited into the account.

15. **Reconciling** a bank statement--another way of saying "balancing the checkbook"; process of getting the checkbook balance and the bank's balance to match.

16. **Serial number**--numbers on bills which identify them.

17. **Service charge**--fee charged by the bank for handling checking accounts.

18. **Signature card**--card on file at the bank that shows the signature of persons authorized to write checks on an account.

19. **Voiding a check**--tearing up a check that has been written incorrectly.

20. **Wants**--something a person has a strong desire for but which is not really necessary.

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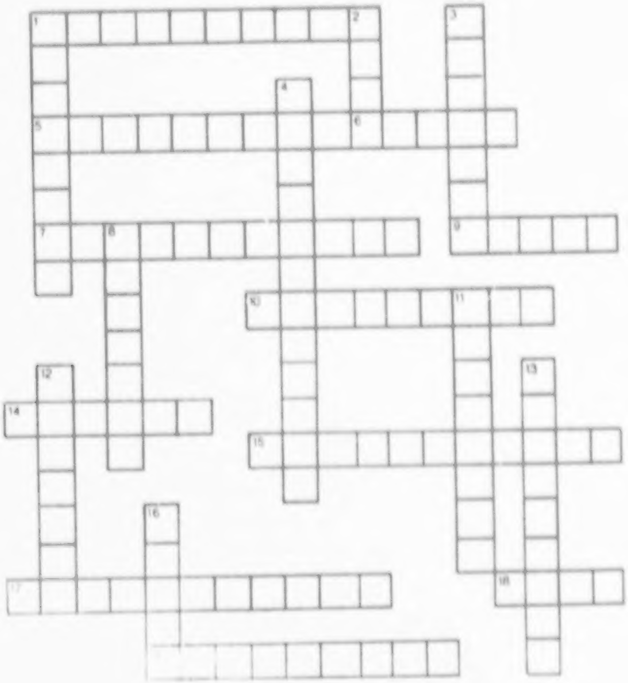
ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME:______________________________ **DATE:**______________________

UNIT:	Common Essential Elements/Personal and Business Management
TOPIC:	Terms and Definitions for Personal and Business Management
UNIT OBJECTIVE:	After completing this unit, the student will be able to demonstrate an understanding of concepts and skills related to personal and business management.
SPECIFIC OBJECTIVE(S):	In completing this assignment sheet, the student will identify terms and definitions associated with personal and business management.
REFERENCE:	Student Information Sheet/Terms and Definitions for Personal and Business Management
DIRECTIONS:	Use the terms on Student Information Sheet/Terms and Definitions for Personal and Business Management to complete the crossword puzzle below.



Across

1 Something of value held by a bank as security to guarantee repayment of a loan

5 A type of guaranteed check

6 Something that is necessary or required for your well-being

7. Signature on the back of a check that allows it to be cashed or deposited

9. _______ National Product

10. Results in a rise in the general price of goods

14. Numbers on bills which identify them

15. Money made by an individual but not approved by the U.S Government

17. Another way of saying "balancing the checkbook"

18. _____ Statement--a report sent periodically to the customer

19. _____ Card--a card on file at the bank that shows the name and handwritting of the person authorized to write checks on an account

Down

1. A check that has been paid by the bank

2. Money borrowed with promise to pay

3. Tearing up a check that has been written

4. Value or size of a piece of money

8. A _____ in transit is one that has been recorded on the account holder's check register but was not processed at the bank.

11. Money charged for borrowed money

12. _____ Charge--fee charged by the bank for handling checks

13. The total amount of checks written on an account is more than the amount deposited into the account.

16. Something a person has a strong desire for

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STUDENT INFORMATION SHEET

ELECTRICAL TRADES I

UNIT: Common Essential Elements/Personal and Business Management

TOPIC: Budgets

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills related to personal and business management.

SPECIFIC OBJECTIVE(S): After completion of this information sheet, the student will be able to demonstrate an understanding of budgets and how they work.

Need for a Budget

Before you begin the development of a budget, you should first understand why you need a budget. We all like for our money to go as far as it can. Budgets assist in making this possible. One reason for having a budget is to stop wasteful spending habits. Budgets help us to set goals for how we wish to use our money. By following your budget, you learn to live on the money you actually have. This allows you to establish a standard of living. Having a budget and knowing where you stand financially will help you in planning for the future as well as the present. Living within your budget allows you to set and achieve long-range spending goals.

Rules of Budgeting

In order to plan your budget, you should learn to recognize the difference between wants and needs. Arrange your spending goals in order of importance to you. While you are planning, set up some kind of savings goal. It's important to try to set aside a part of your income, no matter how small, in order to get into the habit of saving. Learn to think ahead and plan for the future. Keep in mind that you may need to be flexible. This may be necessary if income and expenses change.

Parts of a Budget

The parts of your budget will include income, expenses, and savings. Your income may be in the form of a fixed salary, what you know you will earn, or assumed wages, what you think you will earn.

Expenses may vary from month to month. Some expenses, such as car or house payments, will remain the same and must be paid at specific times. Other expenses, such as utility bills, charge accounts, etc., will go up and down.

The final part of your budget is savings. Savings goals may be classified as short-term, saving for something special like a tape, clothing, or weekend trip, or long-term, saving for a car, college, or getting married.

Planning a budget, regardless of how simple or complex it is, will assist you in reaching your financial goal.

ASSIGNMENT SHEET

ELECTRICAL TRADES I

NAME: ______________________________ **DATE:** ______________________

UNIT: Common Essential Elements/Personal and Business Management

TOPIC: Budgets

UNIT OBJECTIVE: After completing this unit, the student will be able to demonstrate an understanding of concepts and skills related to personal and business management.

SPECIFIC OBJECTIVE(S): In completing this assignment sheet, the student will demonstrate an understanding of budgets and how they work.

REFERENCE: Student Information Sheet/Budgets

DIRECTIONS: Complete your own personal budget using the following information. You bring home $100.00 a month. You have the following expenses:

A. Divide your money among these expenses.

Food for lunches ____

Clothes ______

School supplies ____

Gifts ____

Entertainment ____

B. List any other ways you would like to spend your money.

COMPLIANCE STATEMENT

TITLE VI, CIVIL RIGHTS ACT OF 1964; THE MODIFIED COURT ORDER, CIVIL ACTION 5281, FEDERAL DISTRICT COURT, EASTERN DISTRICT OF TEXAS, TYLER DIVISION

Reviews of local education agencies pertaining to compliance with Title VI Civil Rights Act of 1964 and with specific requirements of the Modified Court Order, Civil Action No. 5281, Federal District Court, Eastern District of Texas, Tyler Division are conducted periodically by staff representatives of the Texas Education Agency. These reviews cover at least the following policies and practices:

(1) acceptance policies on student transfers from other school districts;

(2) operation of school bus routes or runs on a non-segregated basis;

(3) nondiscrimination in extracurricular activities and the use of school facilities;

(4) nondiscriminatory practices in the hiring, assigning, promoting, paying, demoting, reassigning, or dismissing of faculty and staff members who work with children;

(5) enrollment and assignment of students without discrimination on the basis of race, color, or national origin;

(6) nondiscriminatory practices relating to the use of a student's first language; and

(7) evidence of published procedures for hearing complaints and grievances.

In addition to conducting reviews, the Texas Education Agency staff representatives check complaints of discrimination made by a citizen or citizens residing in a school district where it is alleged discriminatory practices have occurred or are occurring.

Where a violation of Title VI of the Civil Rights Act is found, the findings are reported to the Office for Civil Rights, Department of Health, Education and Welfare.

If there is a direct violation of the Court Order in Civil Action No. 5281 that cannot be cleared through negotiation, the sanctions required by the Court Order are applied.

TITLE VII, CIVIL RIGHTS ACT OF 1964; EXECUTIVE ORDERS OF 11246 AND 11357; TITLE IX, 1973 EDUCATION AMENDMENTS; REHABILITATION ACT OF 1973 AS AMENDED; 1974 AMENDMENTS TO THE WAGE-HOUR LAW EXPANDING THE AGE DISCRIMINATION IN EMPLOYMENT ACT OF 1967: AND VIETNAM ERA VETERANS READJUSTMENT ASSISTANCE ACT OF 1972 AS AMENDED IN 1974.

It is the policy of the Texas Education Agency to comply fully with the nondiscrimination provisions of all federal and state laws and regulations by assuring that no person shall be excluded from consideration for recruitment, selection, appointment, training, promotion, retention, or any other personnel action, or be denied any benefits or participation in any programs or activities which it operates on the grounds of race, religion, color, national origin, sex, handicap, age, or veteran status (except where age, sex, or handicap constitute a bona fide occupational qualification necessary to proper and efficient administration). The Texas Education Agency makes positive efforts to employ and advance in employment all protected groups.